

Analysis and Evaluation of DAWN and Dropsonde Wind Measurements and Divergence for CPEX

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CPEX Science Team Workshop
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7 June 2018

Original DAWN CPEX Science Objectives

- 1) Utilize DAWN to study the dynamics of convective cloud initiation, maintenance, and decay, particularly over open tropical waters
- 2) Study the dynamics of the tropical atmosphere and tropical convection by flying missions that allow us to compute mass budgets for 100 km x 100 km x 6-10 km volumes containing various degrees and life cycle of convection**
- 3) Provide cal/val for numerical models and other instruments
- 4) Improve model assimilation of lidar wind observations into numerical weather prediction models (Z. Pu)

2017-06-11 19:00:00

June 11, 2017



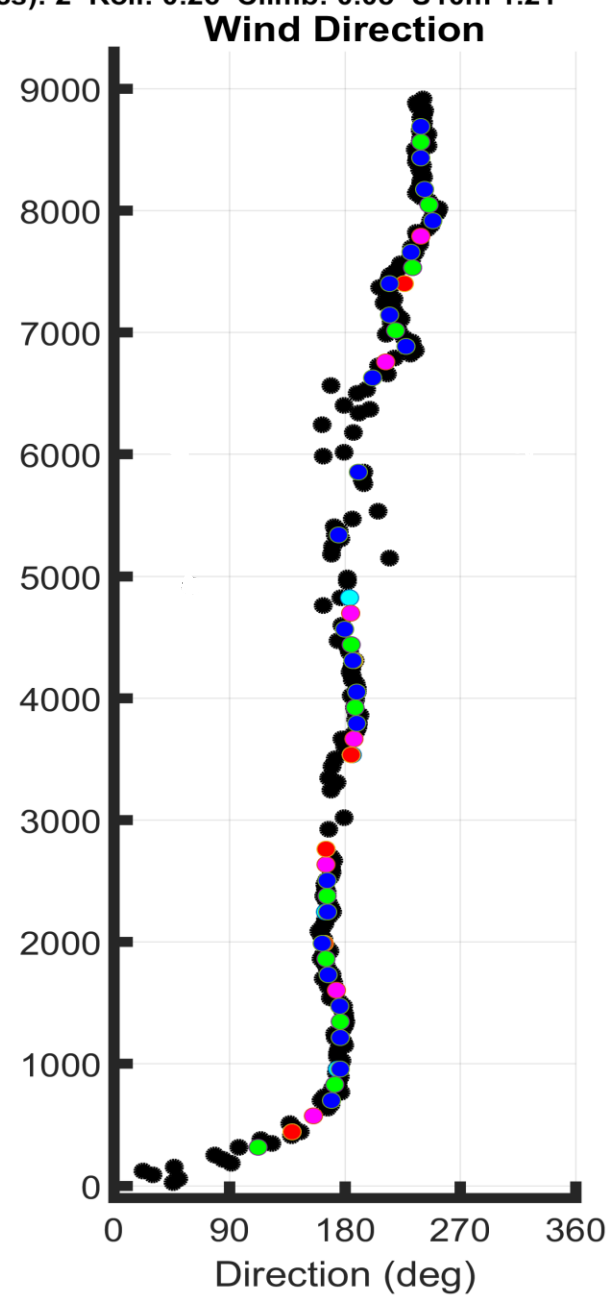
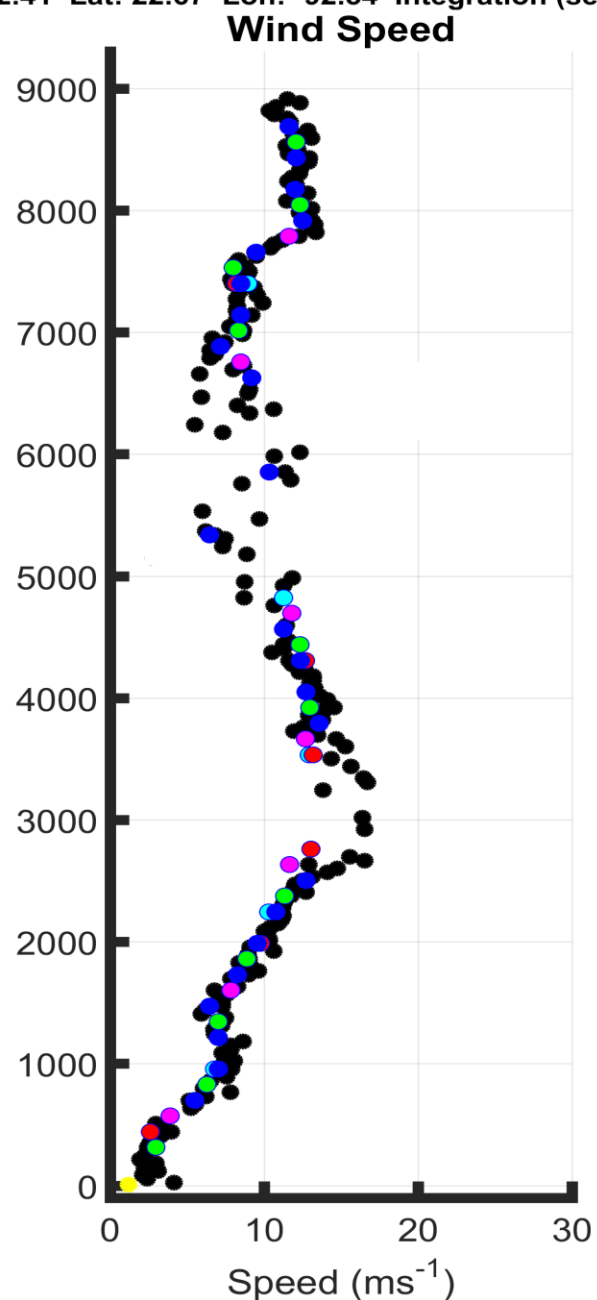
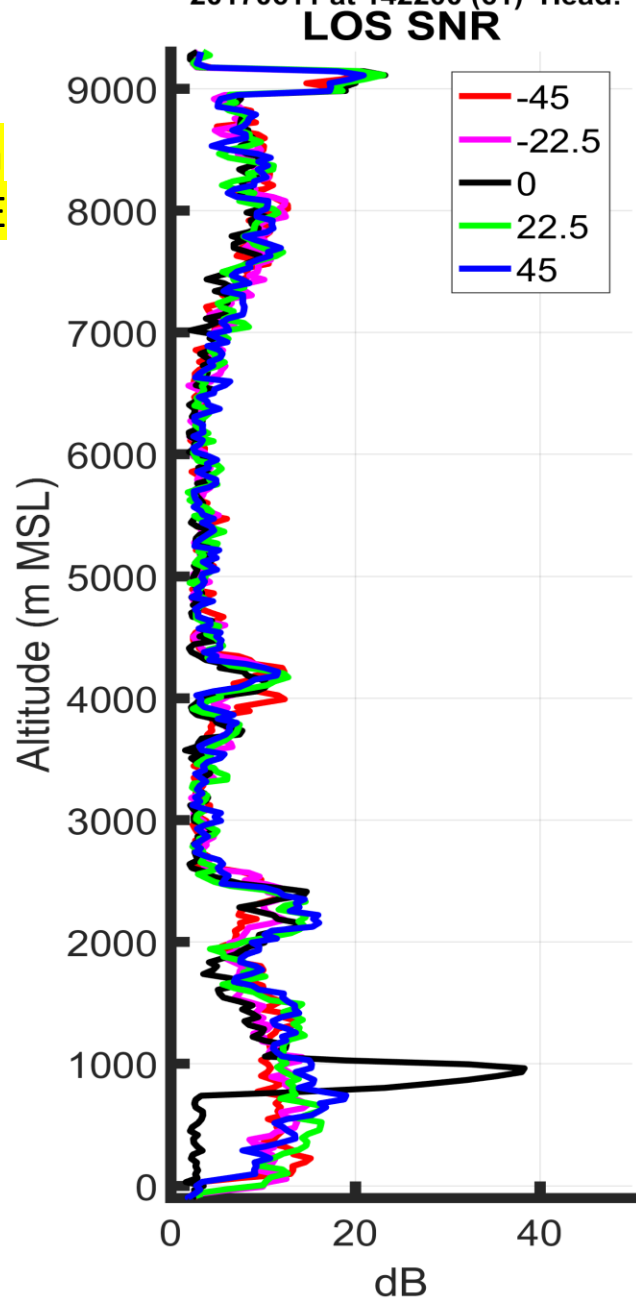
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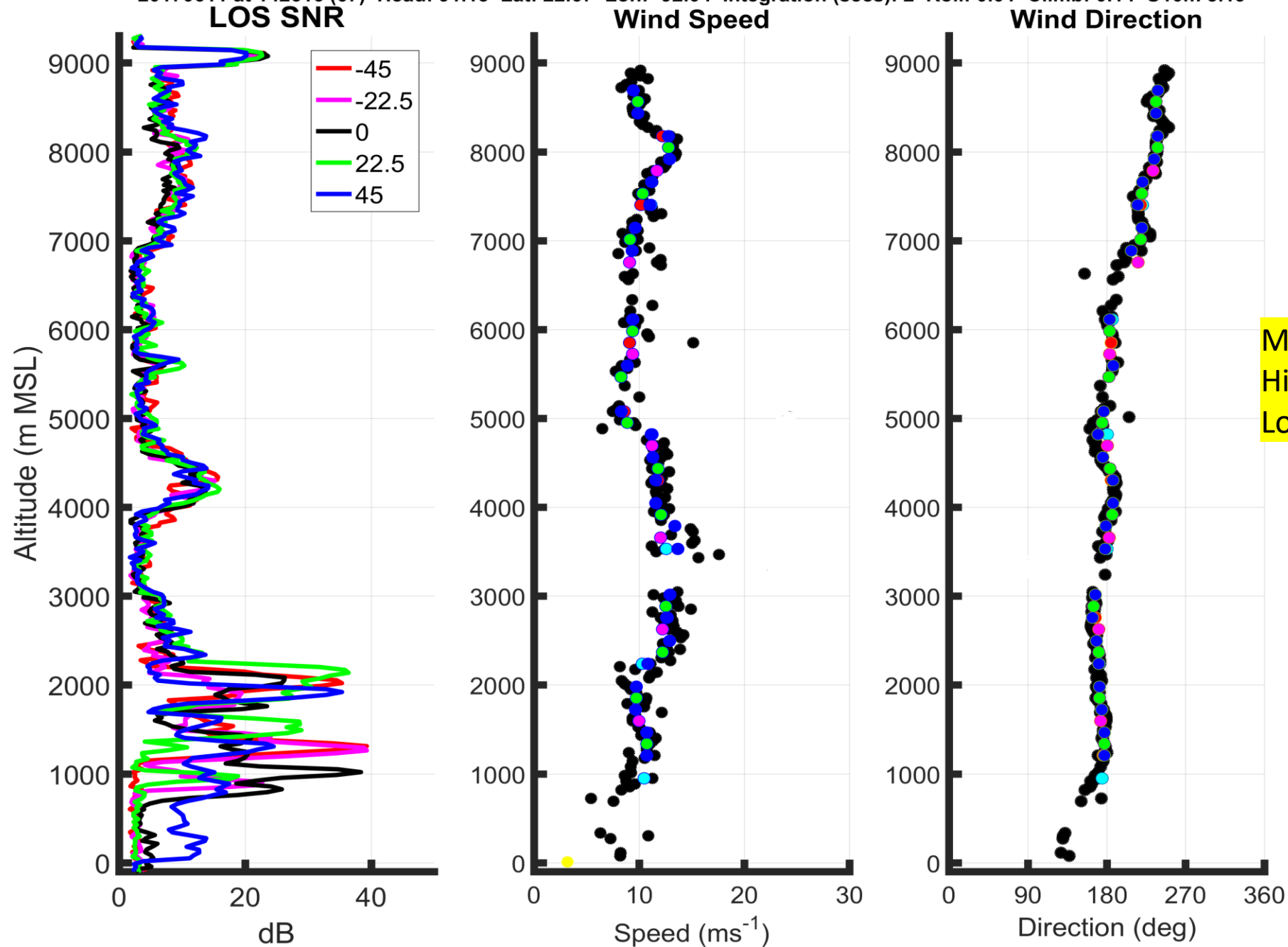
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus



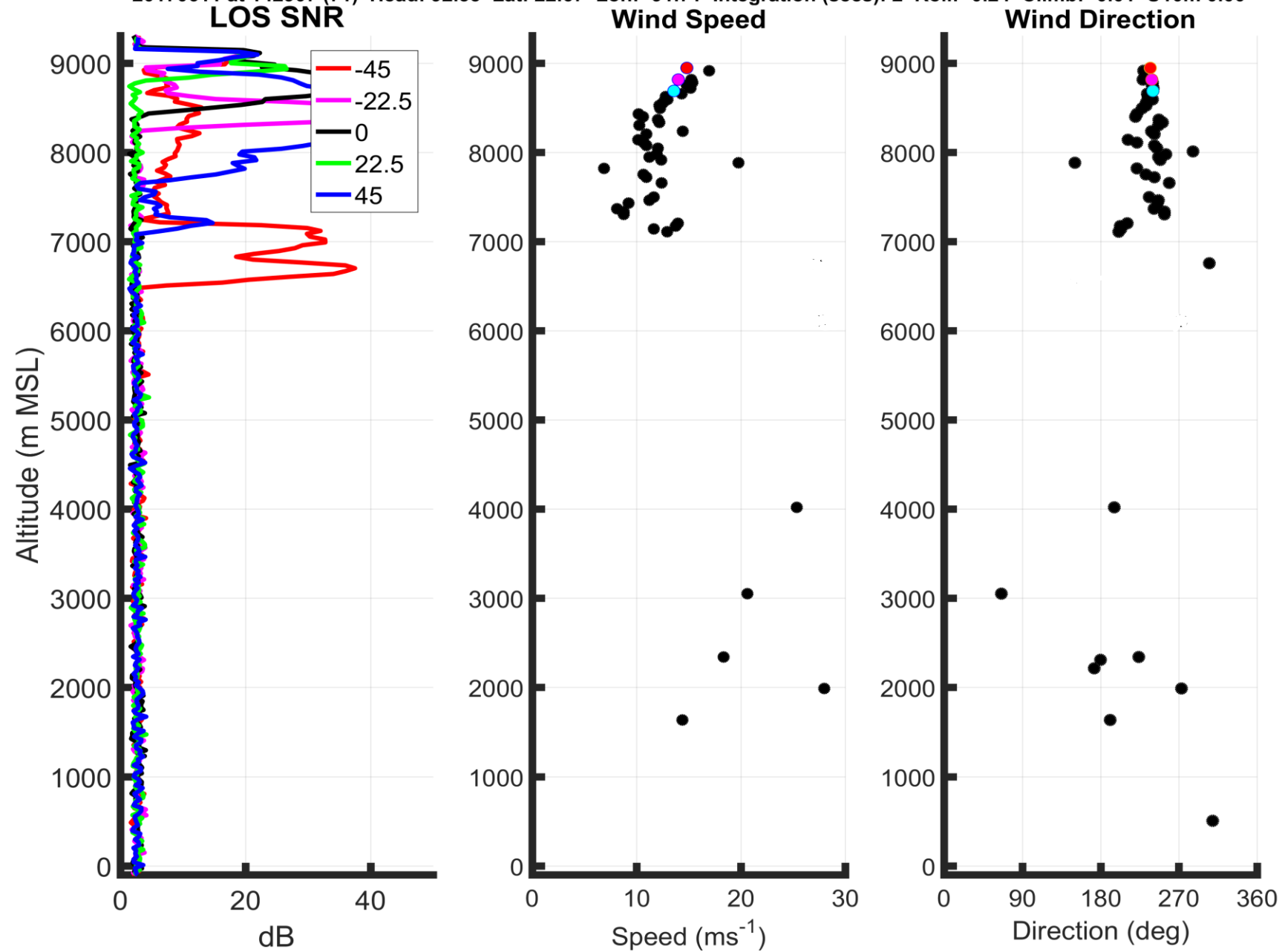
100 mi

Circled Area
Moving W-E





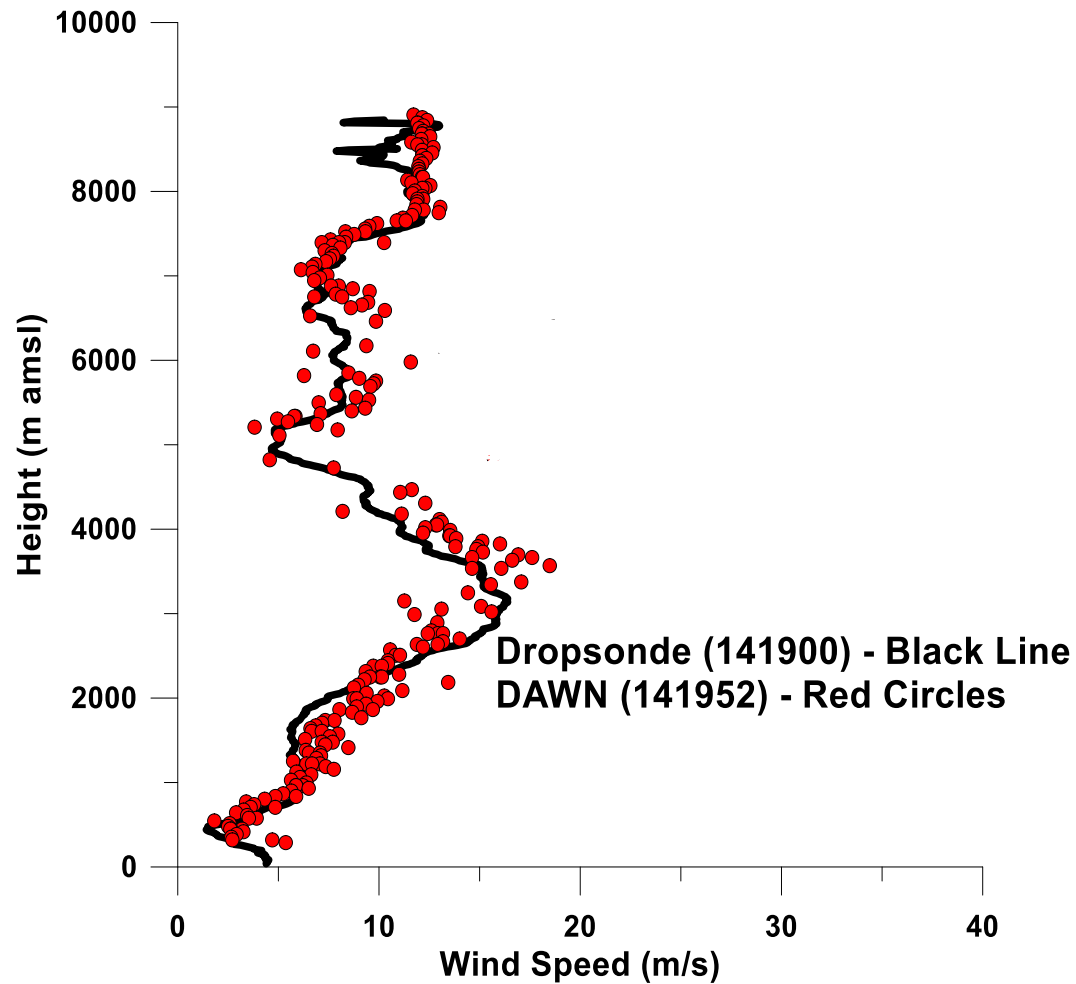
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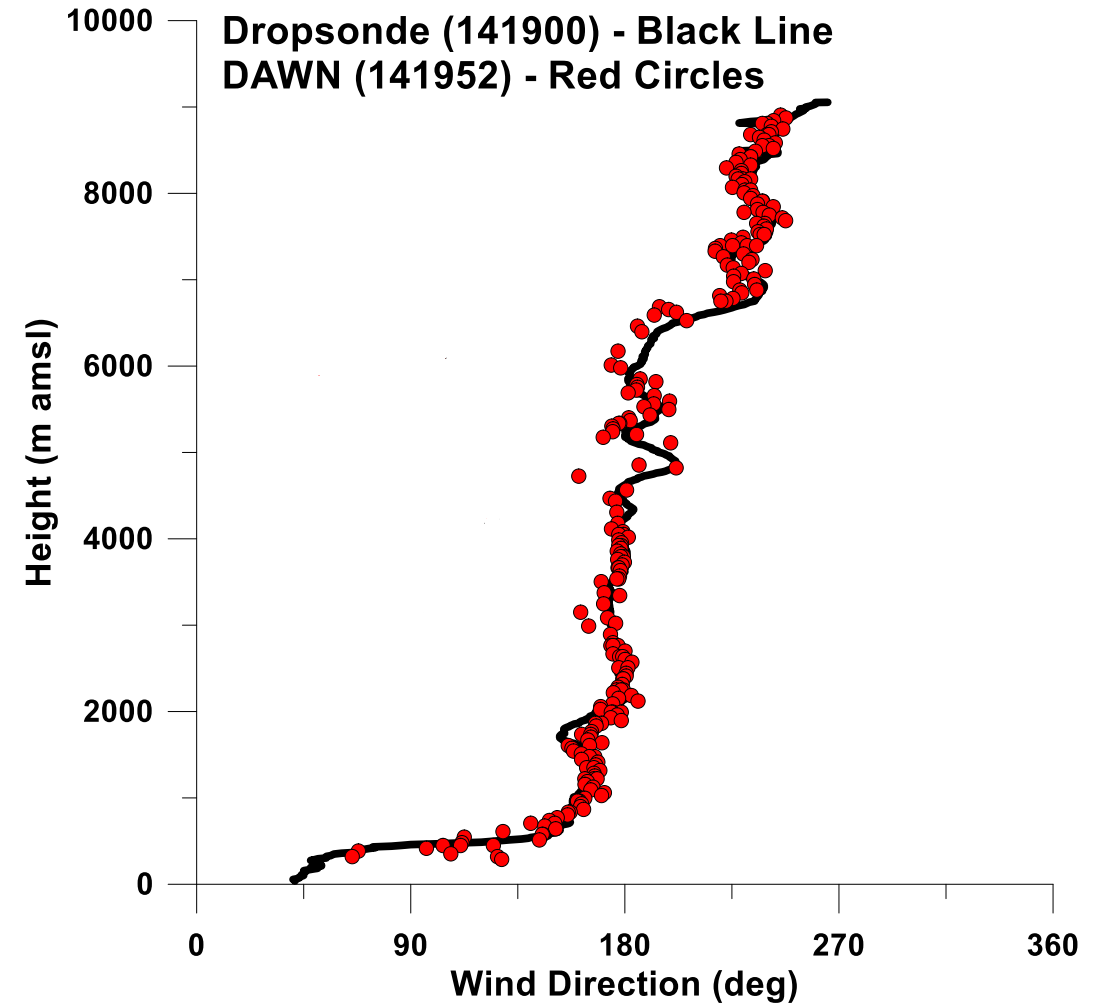
061117

Western S-N Leg A

CPEX DAWN - DROPSONDE COMPARISON
Wind Speed
06/11/17

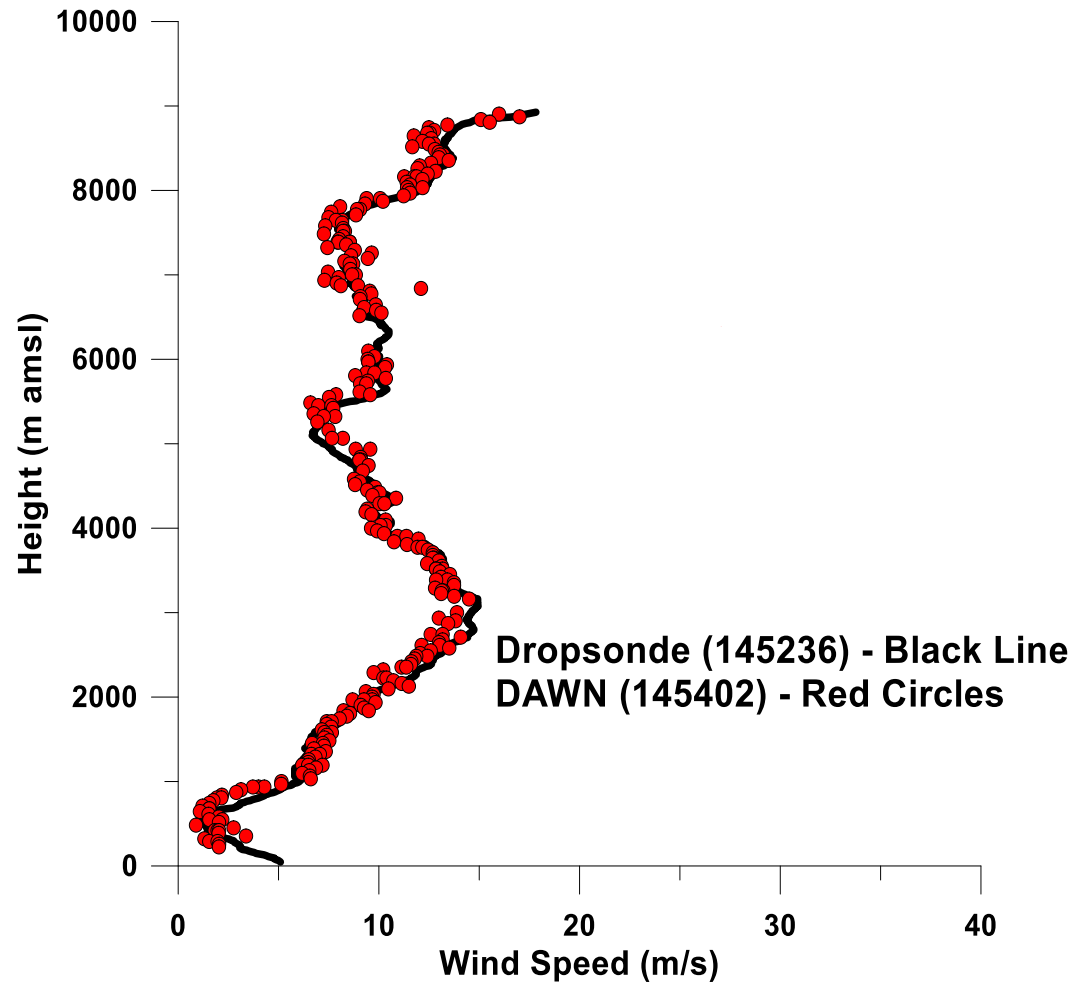


CPEX DAWN - DROPSONDE COMPARISON
Wind Direction
06/11/17

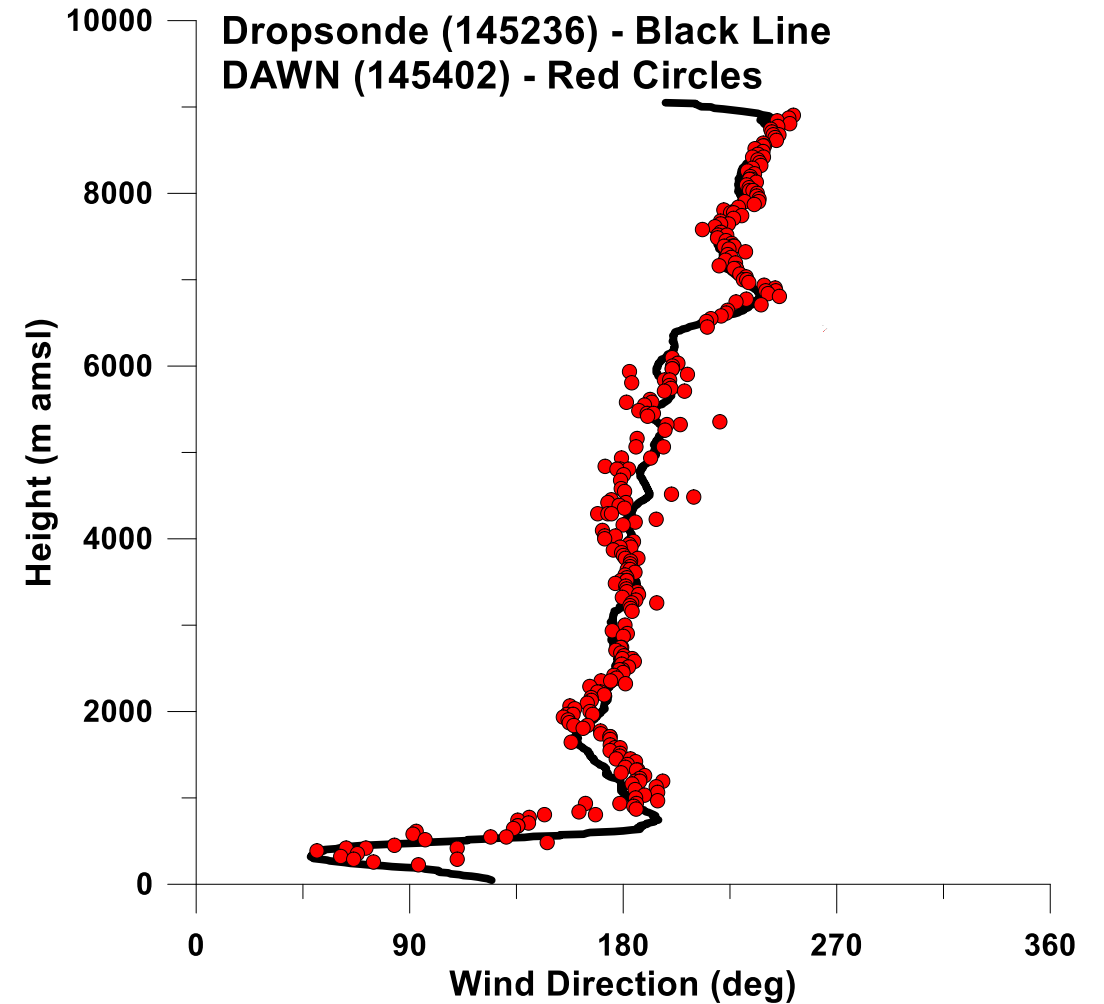


Western S-N Leg B

CPEX DAWN - DROPSONDE COMPARISON
Wind Speed
06/11/17



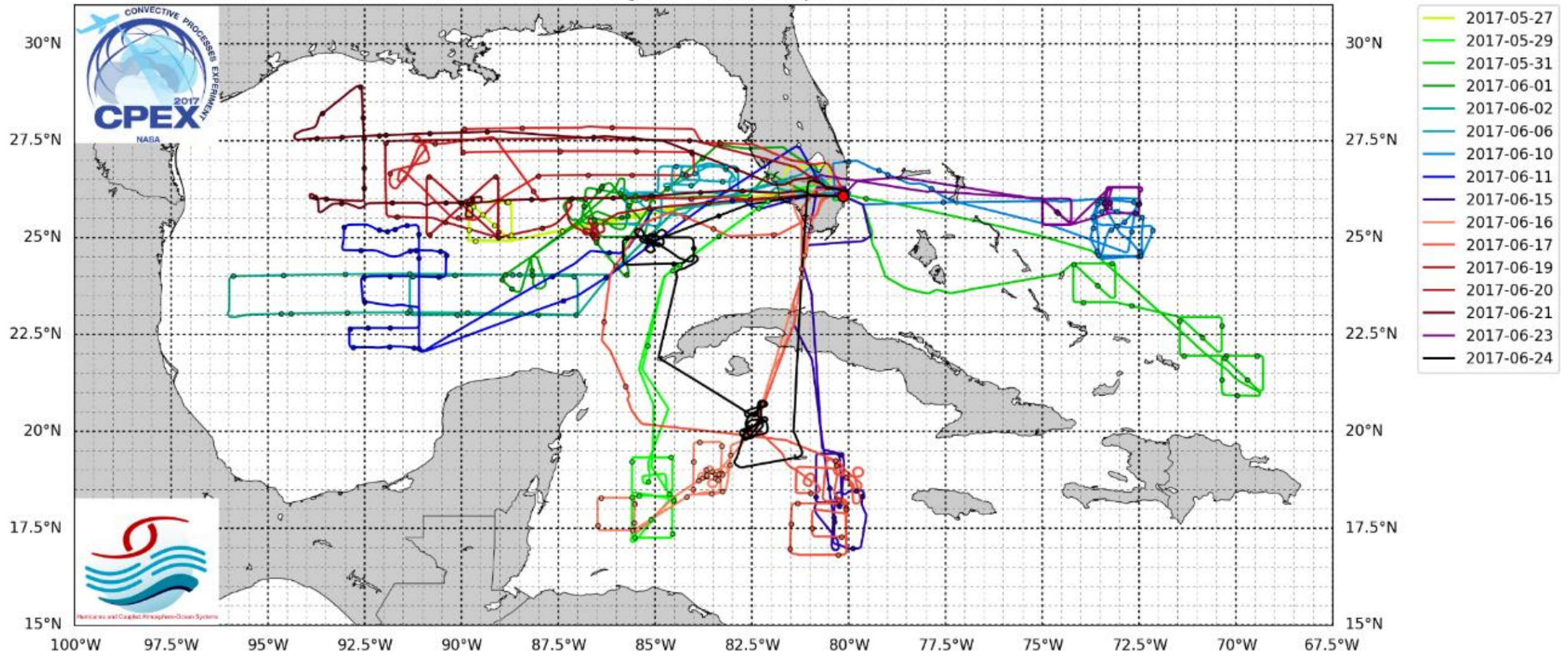
CPEX DAWN - DROPSONDE COMPARISON
Wind Direction
06/11/17



CPEX Mass Budget Science

- Objective
 - Compute mass budgets and divergence for ~ 100 km x 100 km x 6-10 km volumes containing various degrees of cloud coverage to help describe the dynamics of the atmosphere over the tropical ocean
- CPEX Boxes
 - **Over 20 ~ 100 km x 100 km boxes were flown during CPEX 2017 which included:**
 - 1) Undisturbed conditions
 - 2) Disorganized or scattered/broken convection
 - 3) Decaying convection
 - 4) Organized (line/area) convective system (difficult for DAWN)

NASA CPEX 2017 Flight Tracks with Dropsonde Locations



2017-05-27 21:00:00

May 27, 2017

100 km

202827 210606

203909
211757

205728

202015

194958

214017

Google earth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

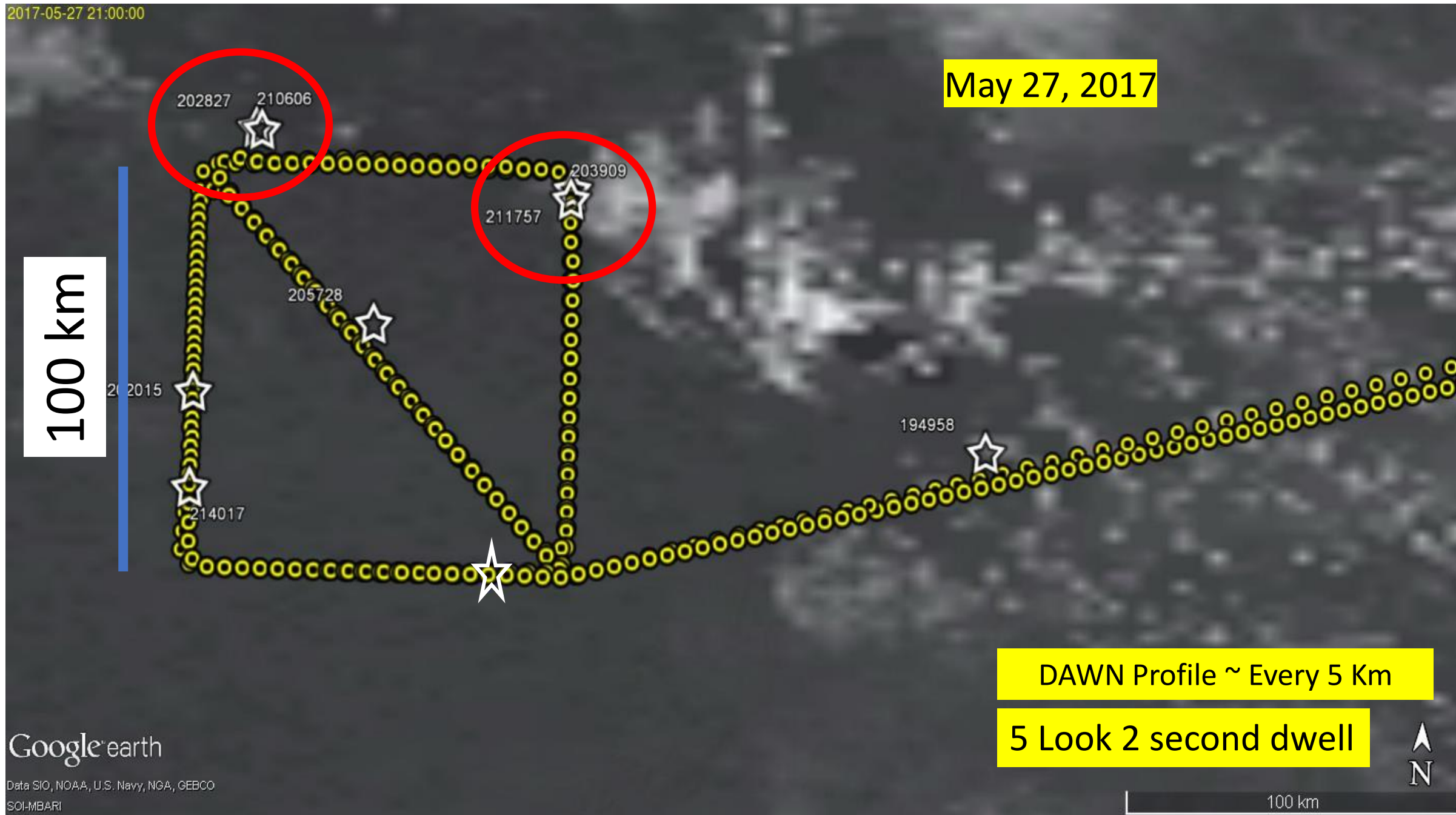
SOI-MBARI

DAWN Profile ~ Every 5 Km

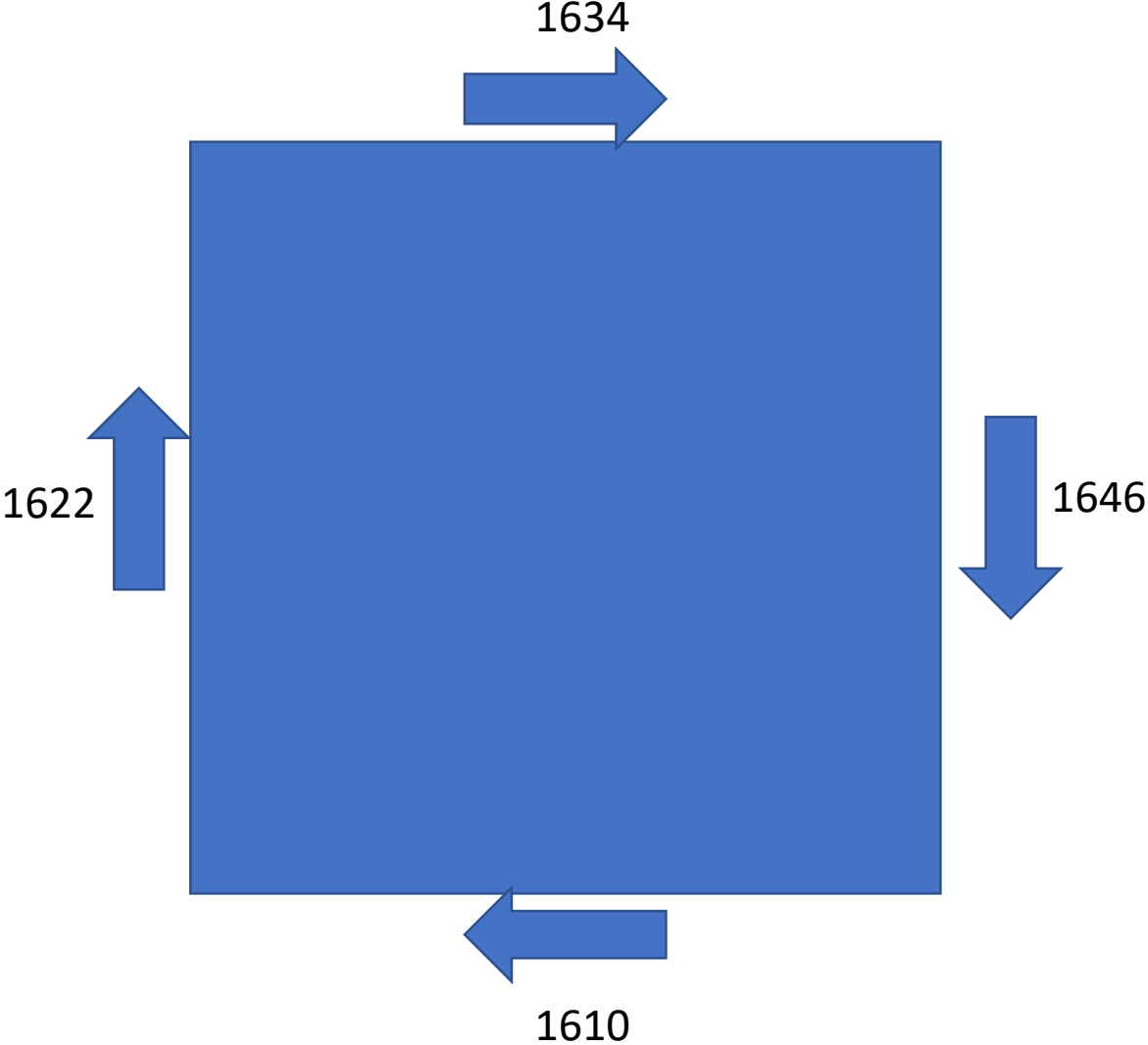
5 Look 2 second dwell

N

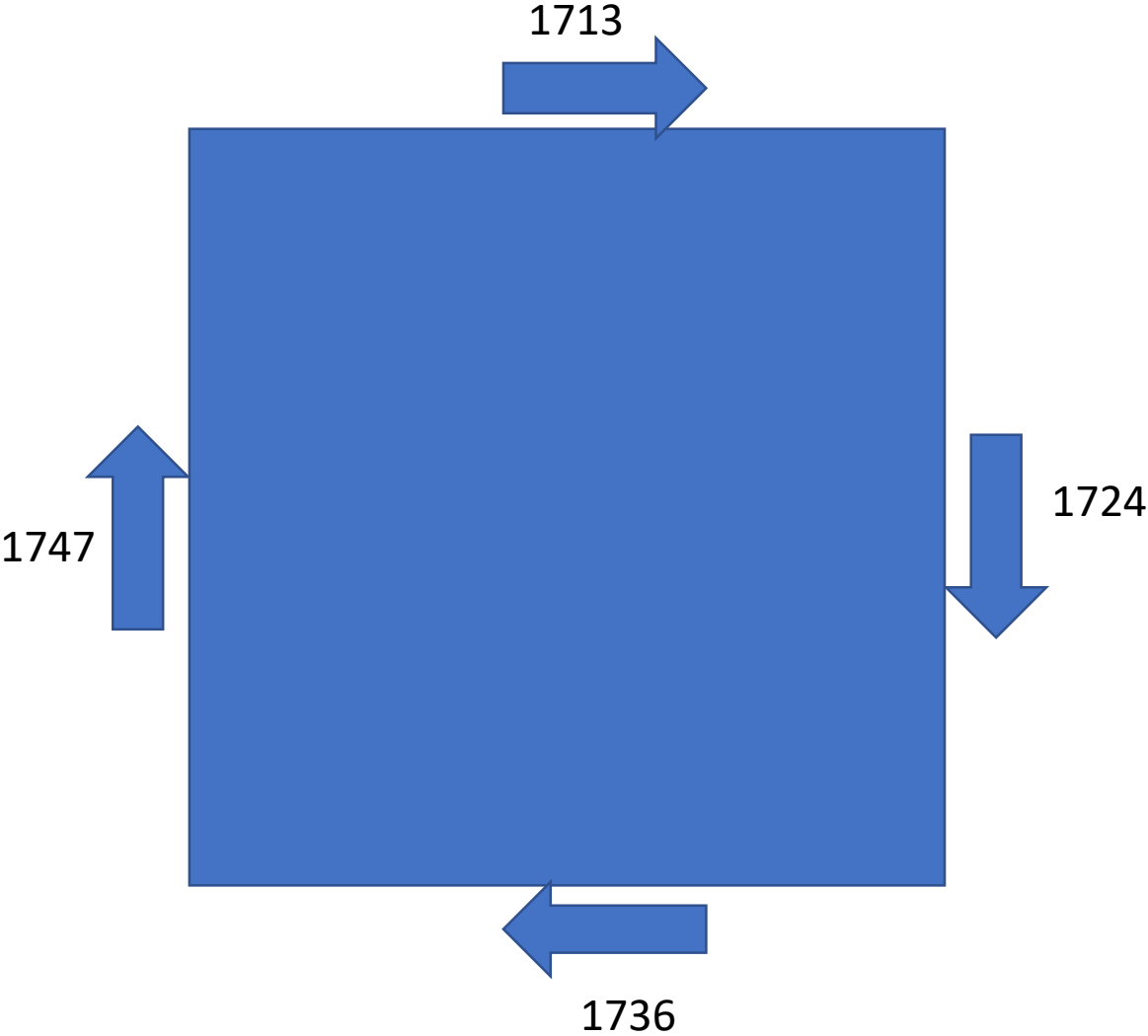
100 km



BOX A

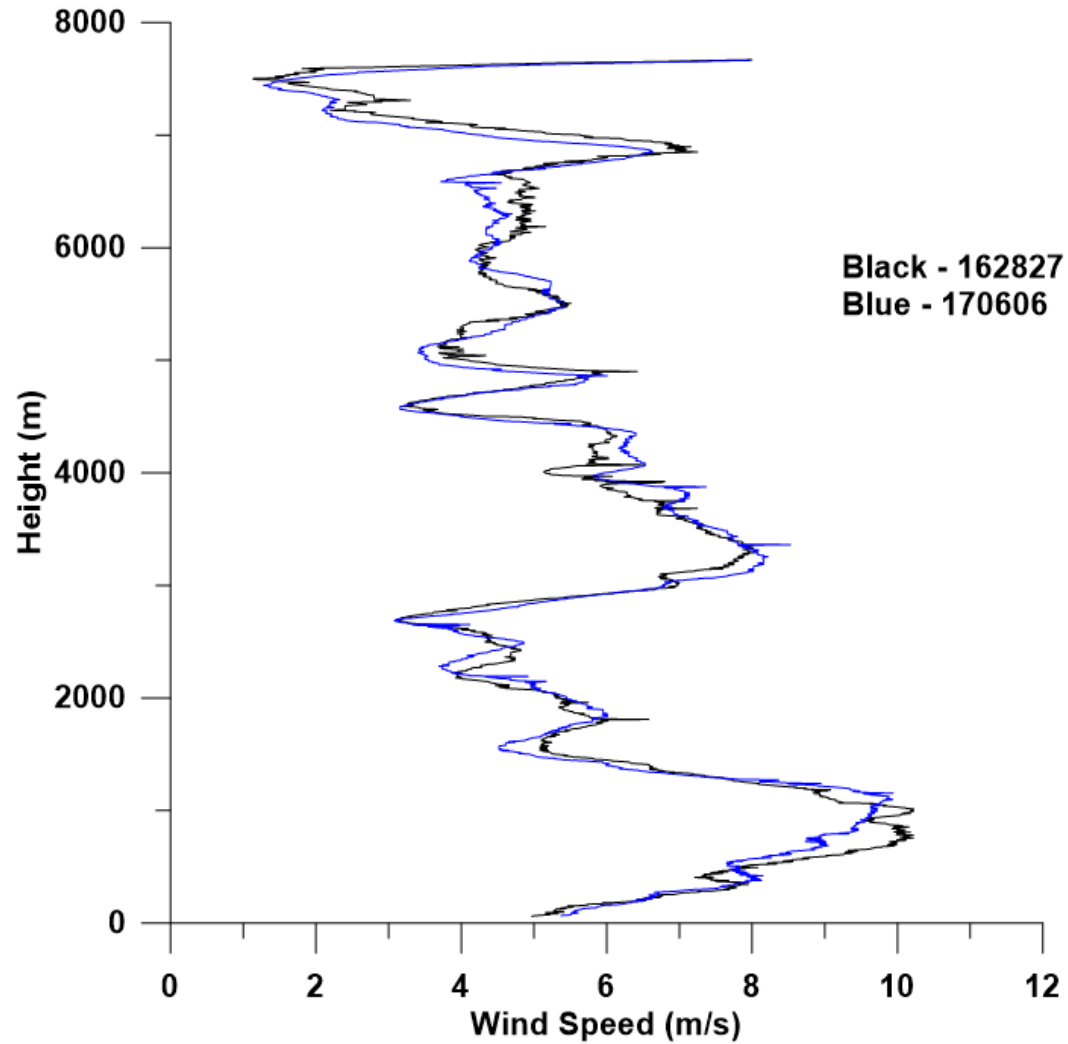


BOX B

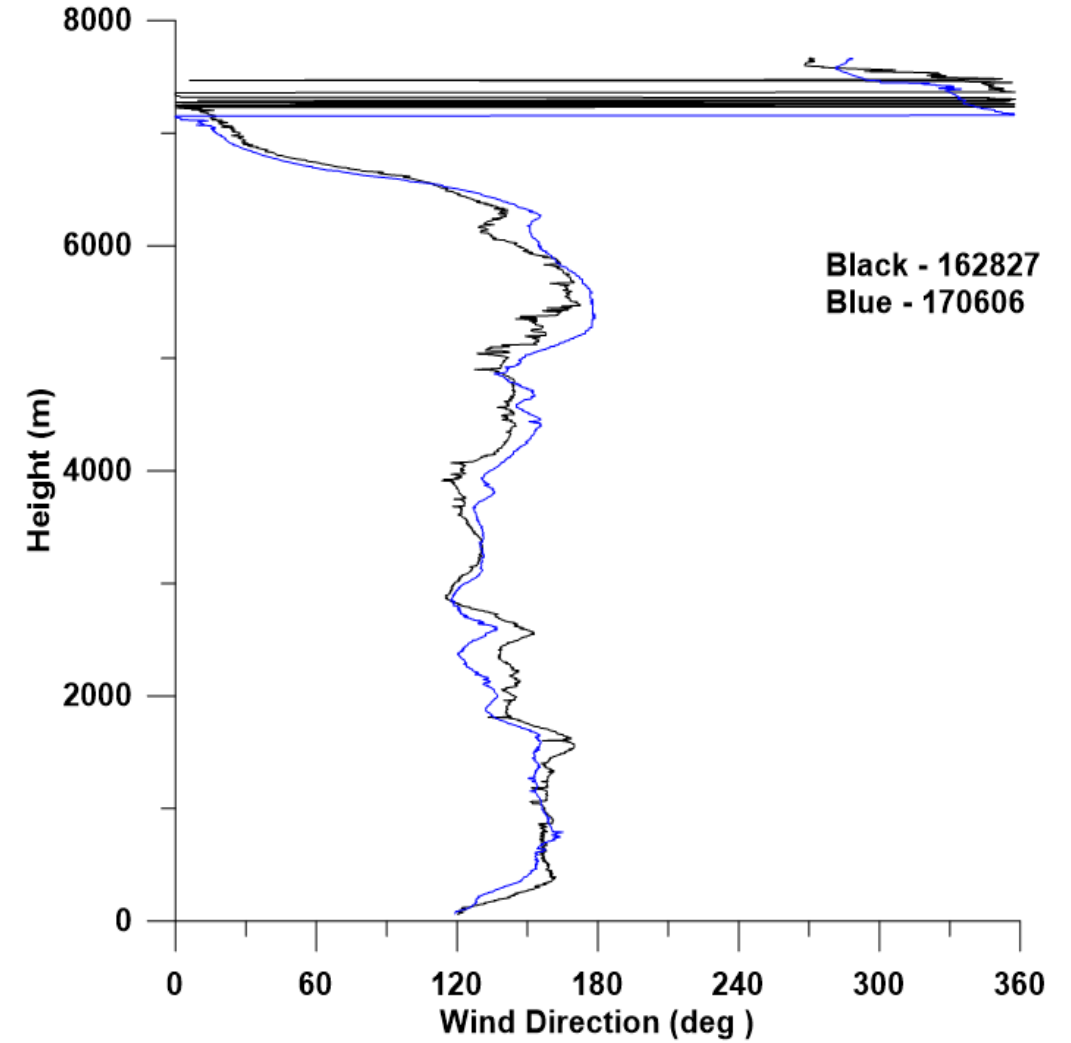


DROPSONDE - Start of Northern W-E Leg Both Boxes

Wind Speed Drops (0527)

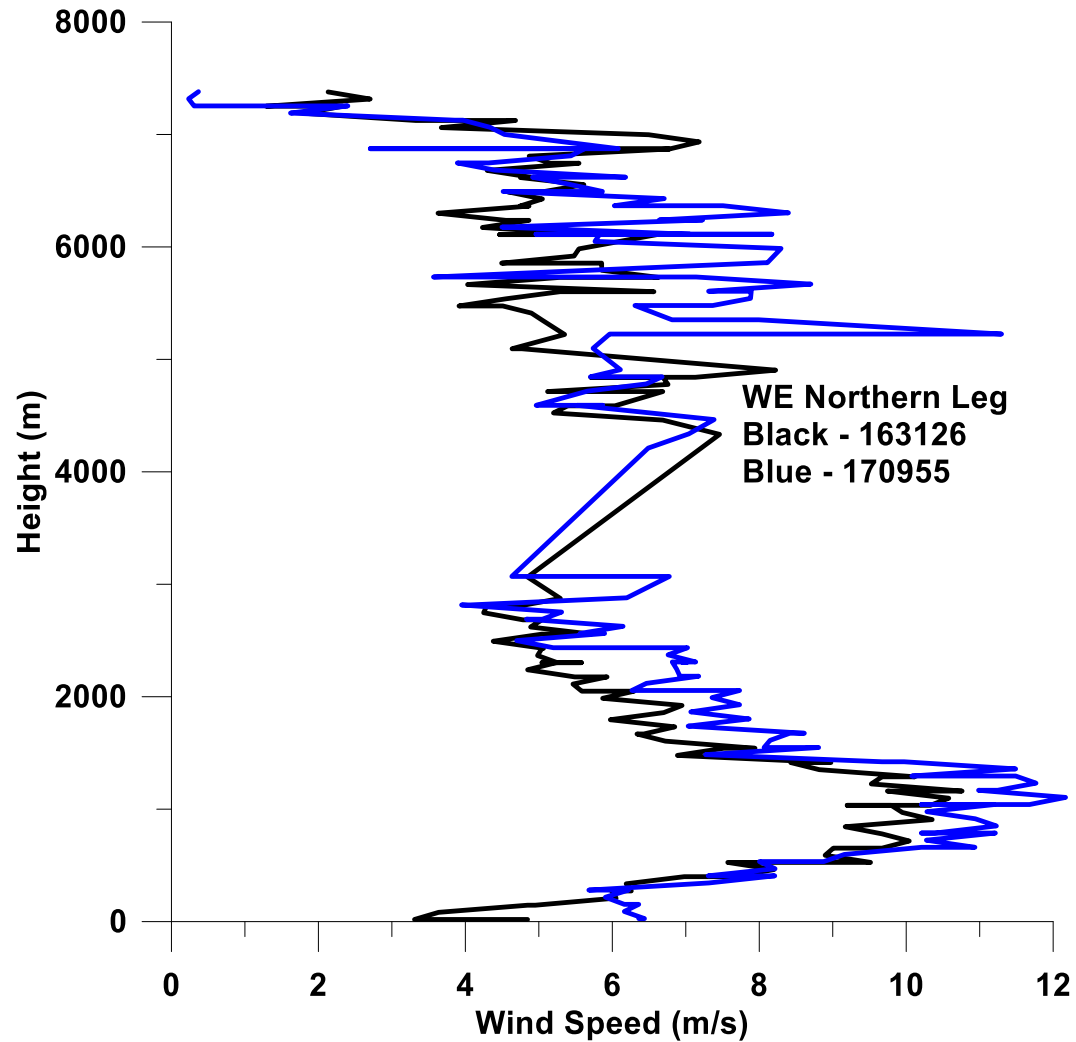


Wind Direction Drops (0527)

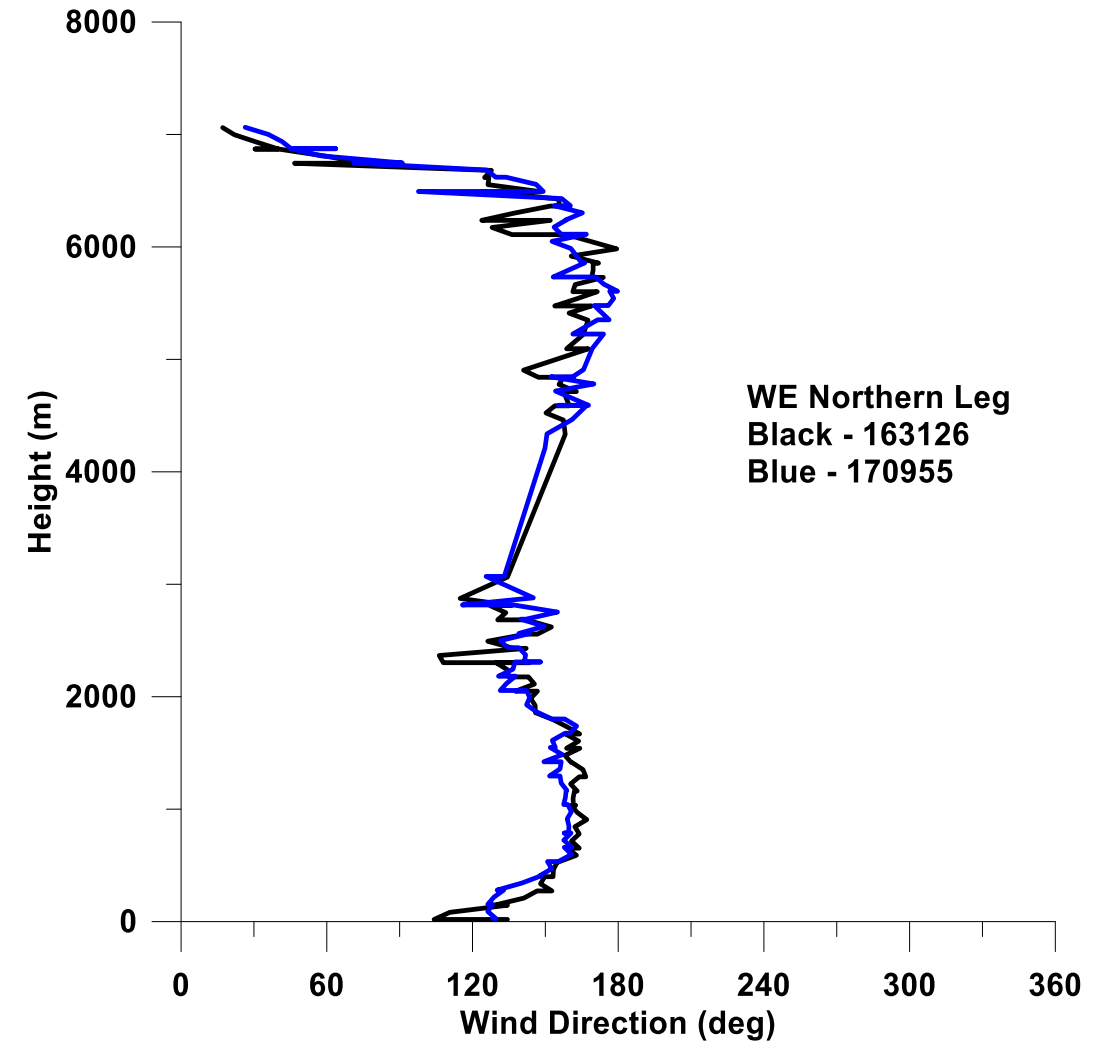


DAWN - Start of Northern W-E Leg Both Boxes

~ Co-located DAWN PROFILES
Wind Speed (m/s)

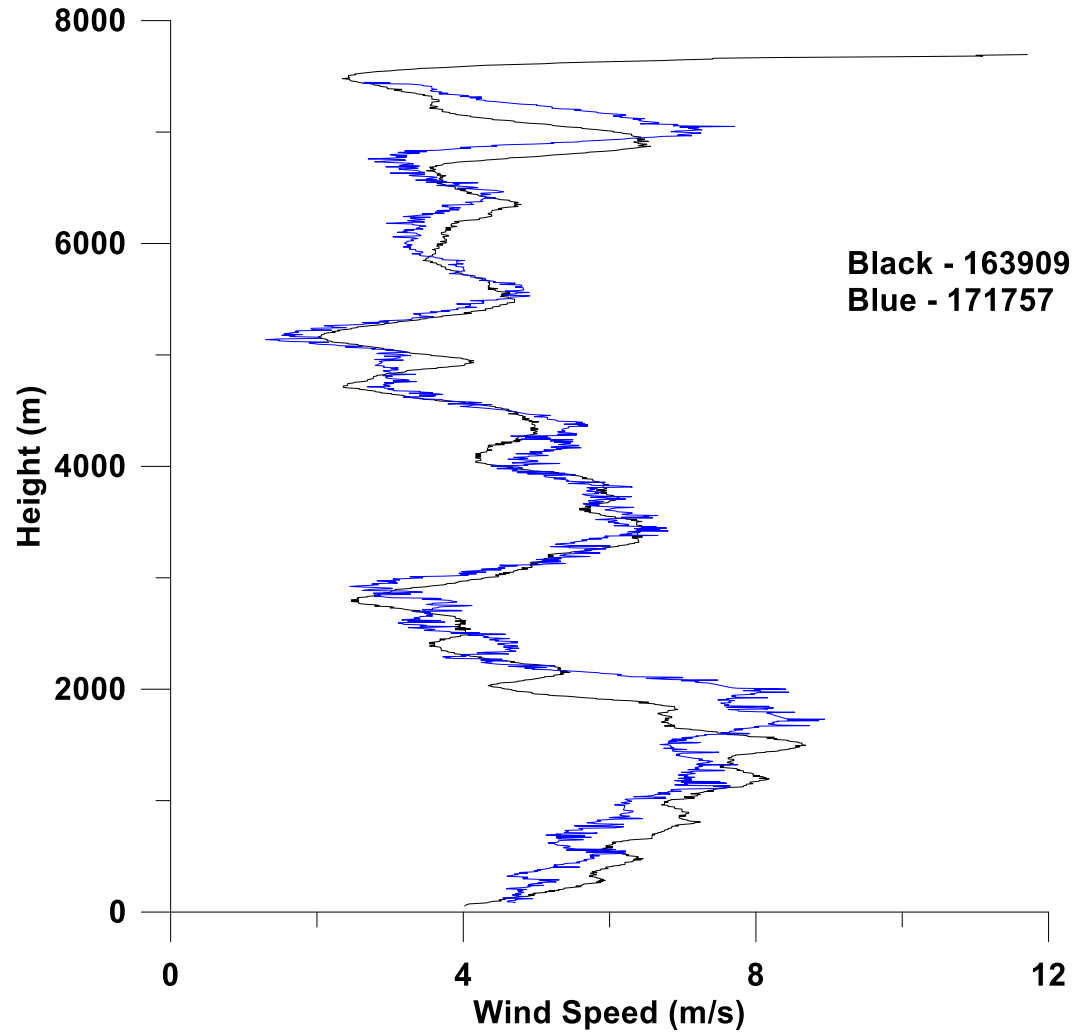


~ Co-located DAWN PROFILES
Wind Direction (deg)

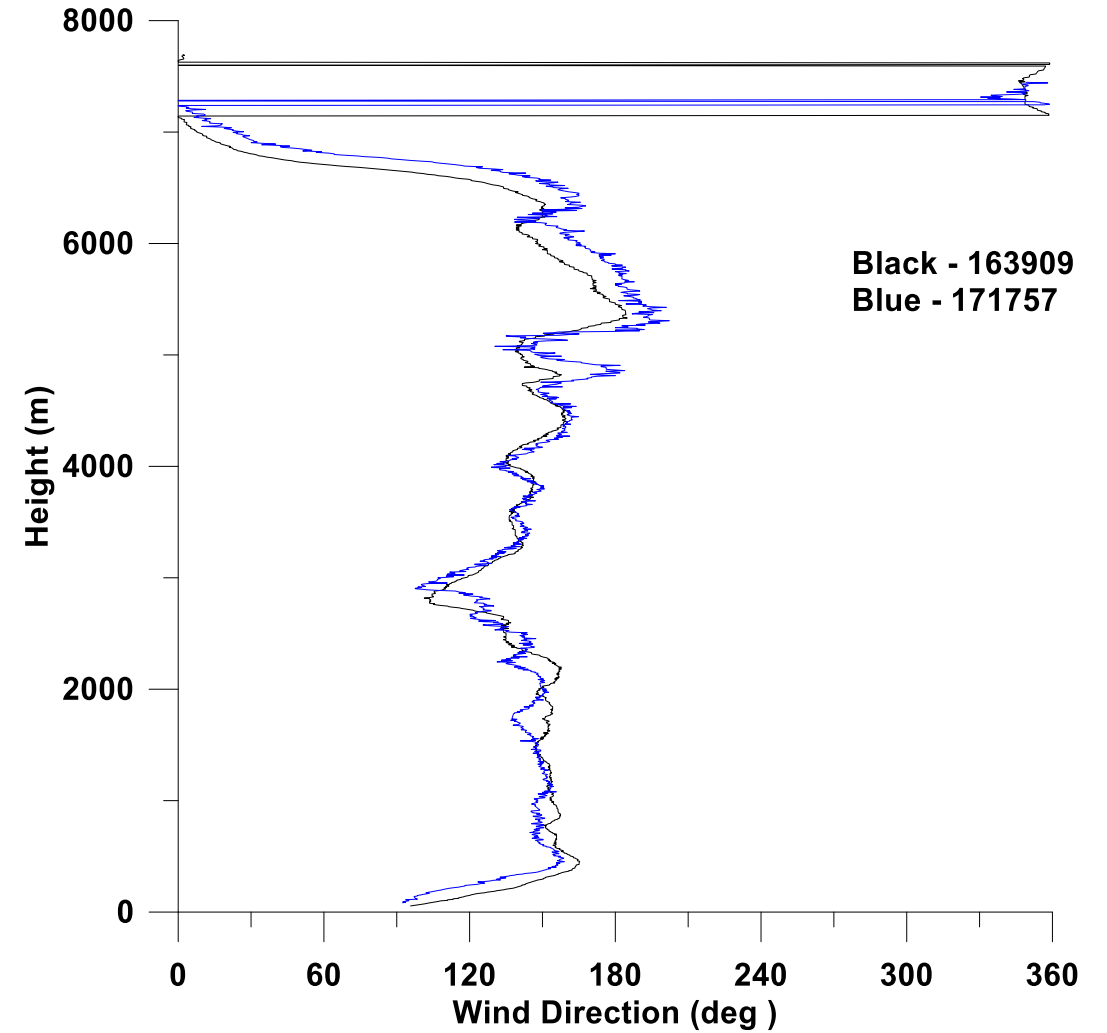


DROPSONDE - Eastern N-S Leg Both Boxes

Wind Speed Drops (0527)

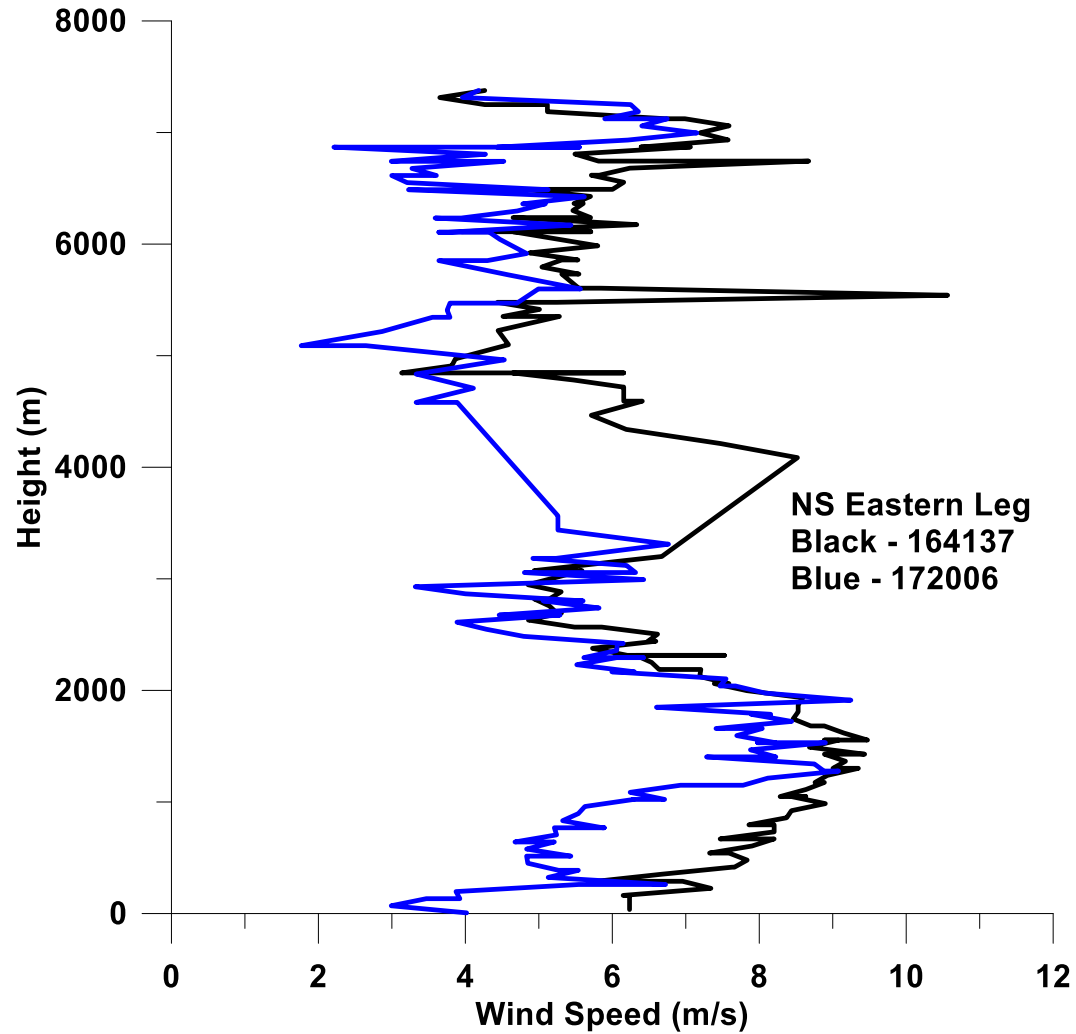


Wind Direction Drops (0527)

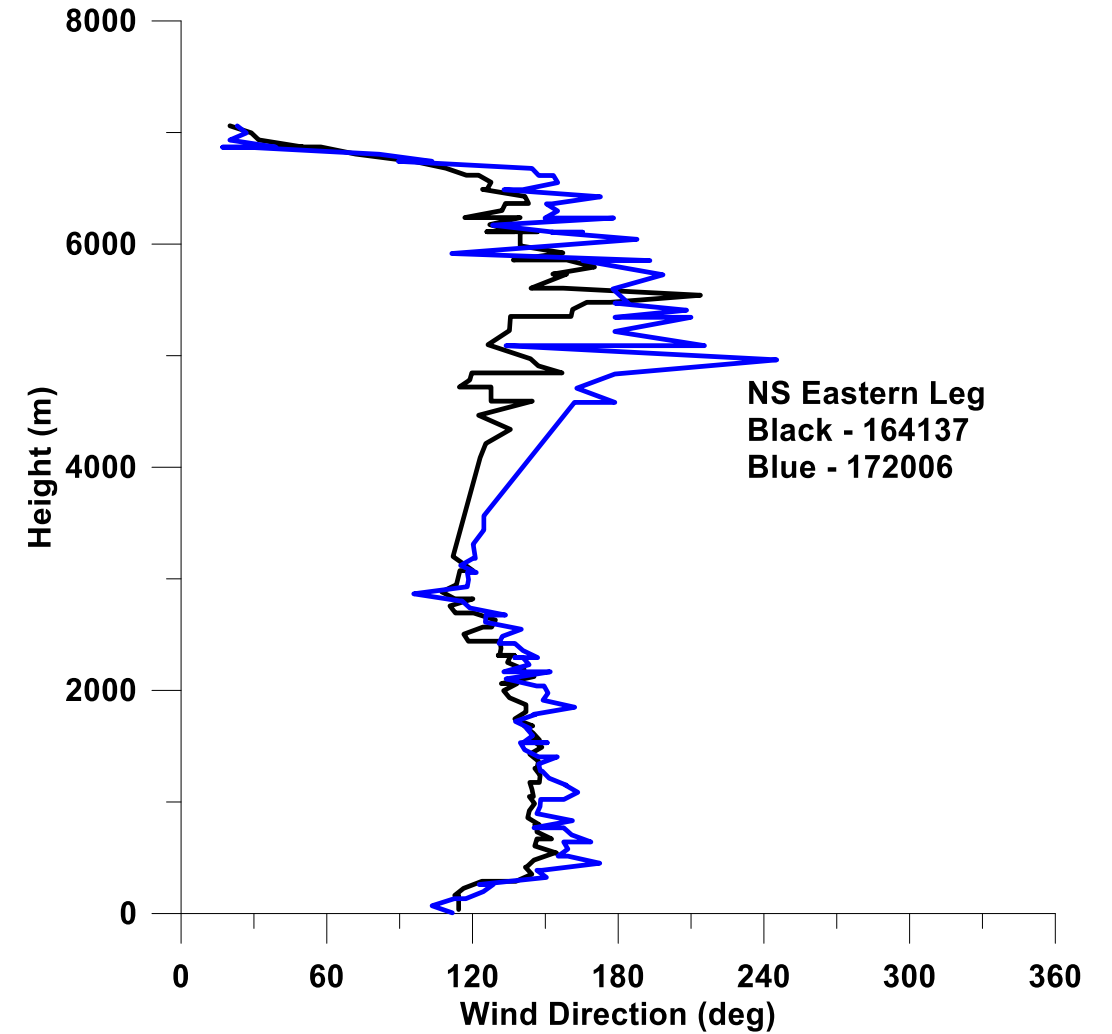


DAWN - Eastern N-S Leg Both Boxes

~ Co-located DAWN PROFILES
Wind Speed (m/s)



~ Co-located DAWN PROFILES
Wind Direction (deg)

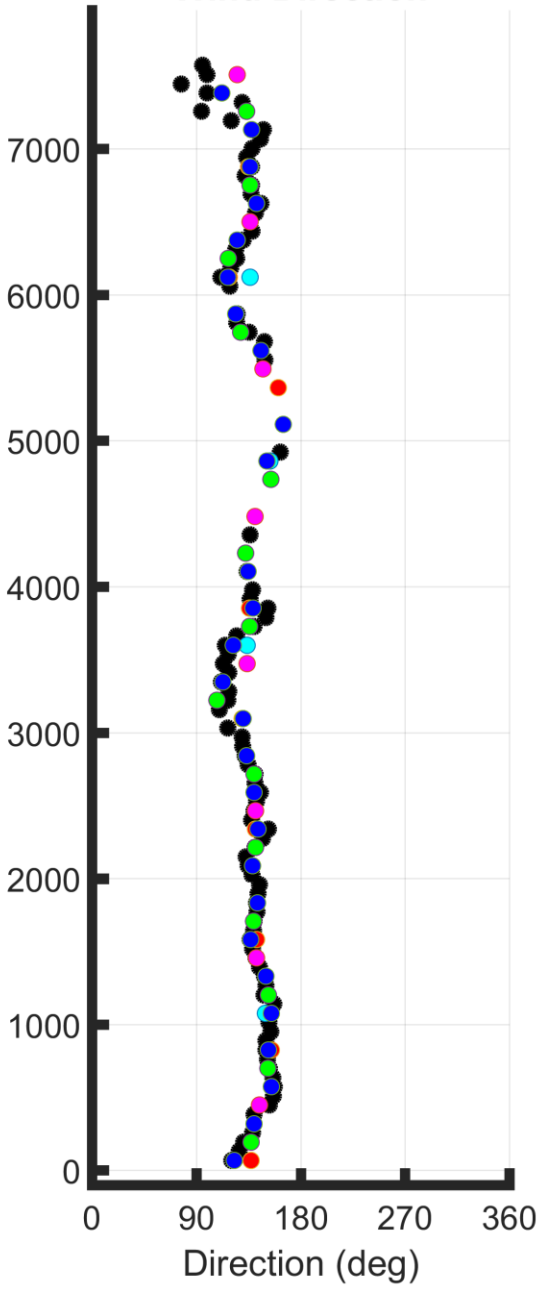
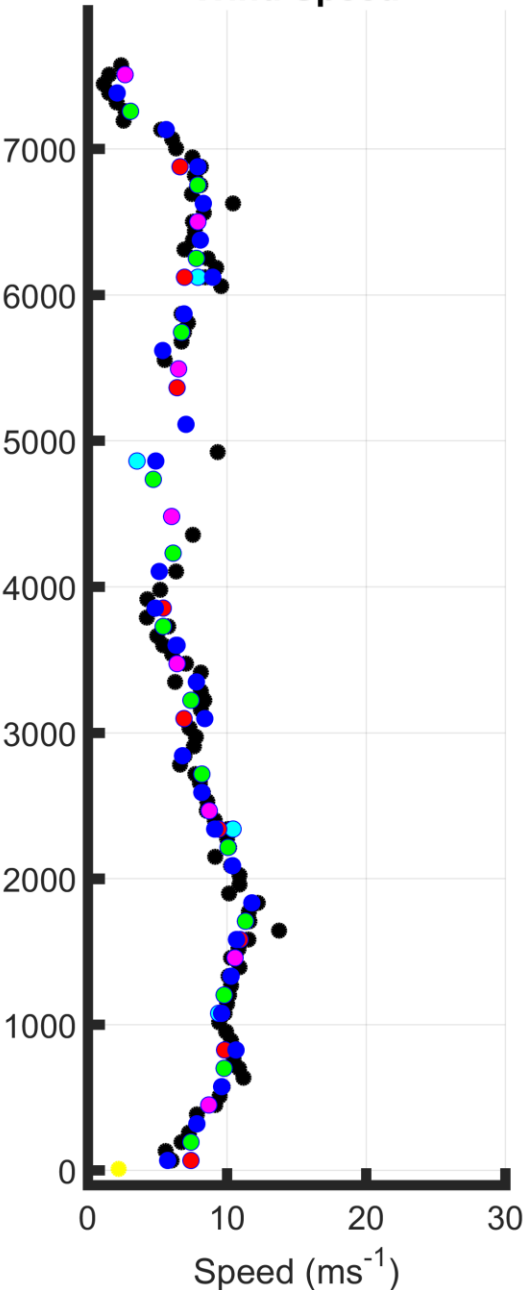
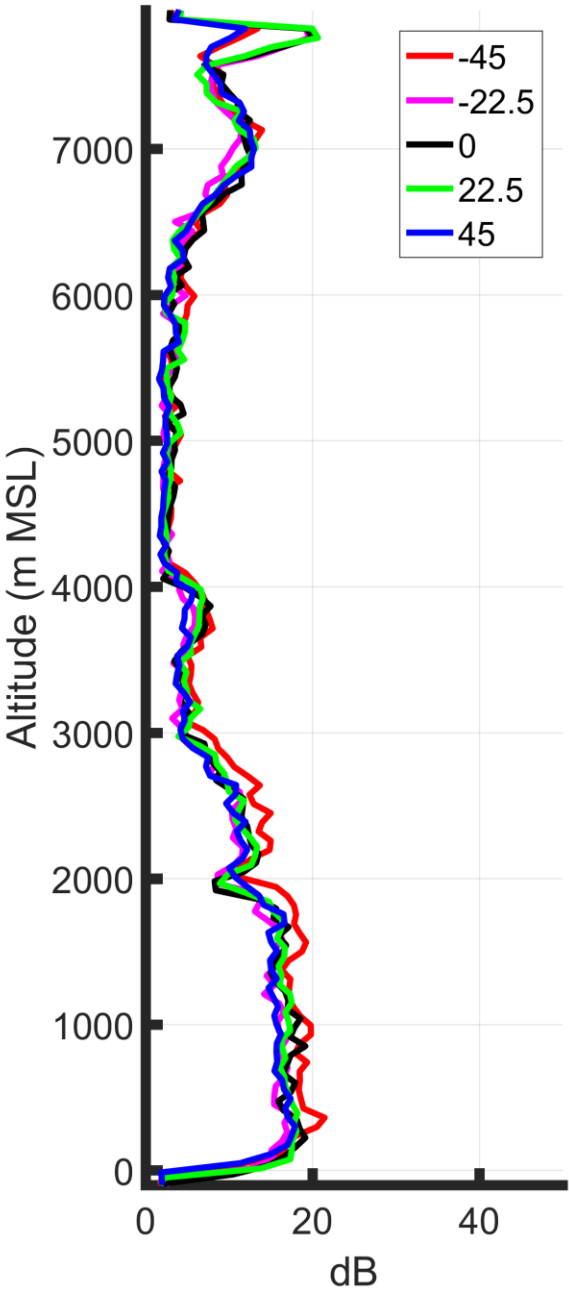


LOS SNR

Wind Speed

Wind Direction

Mid Point Box A
Southern Leg

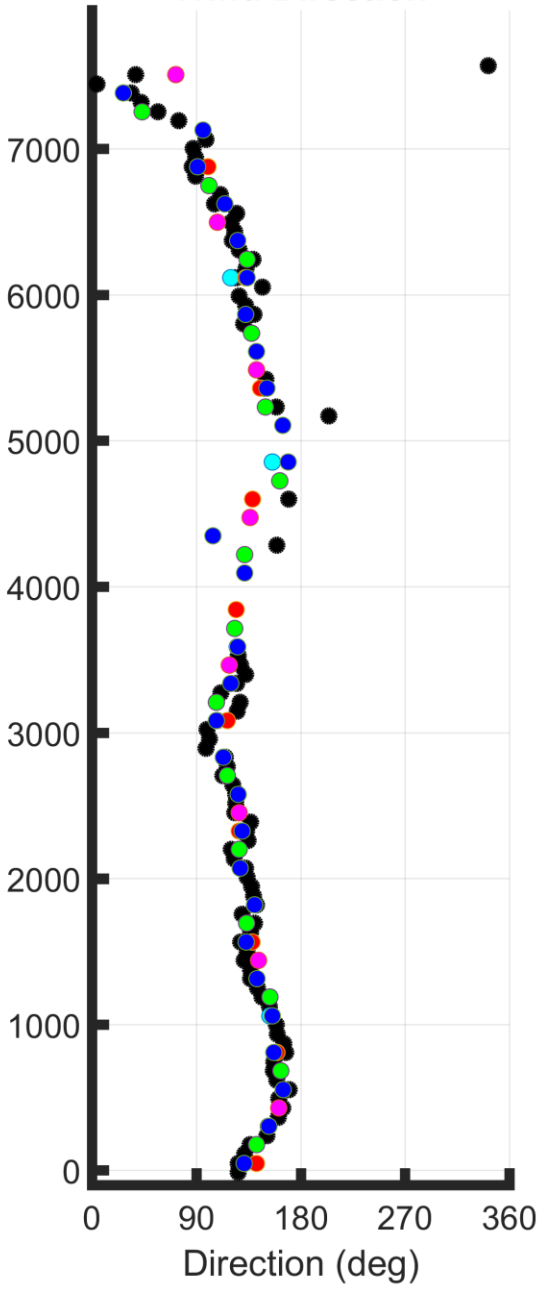
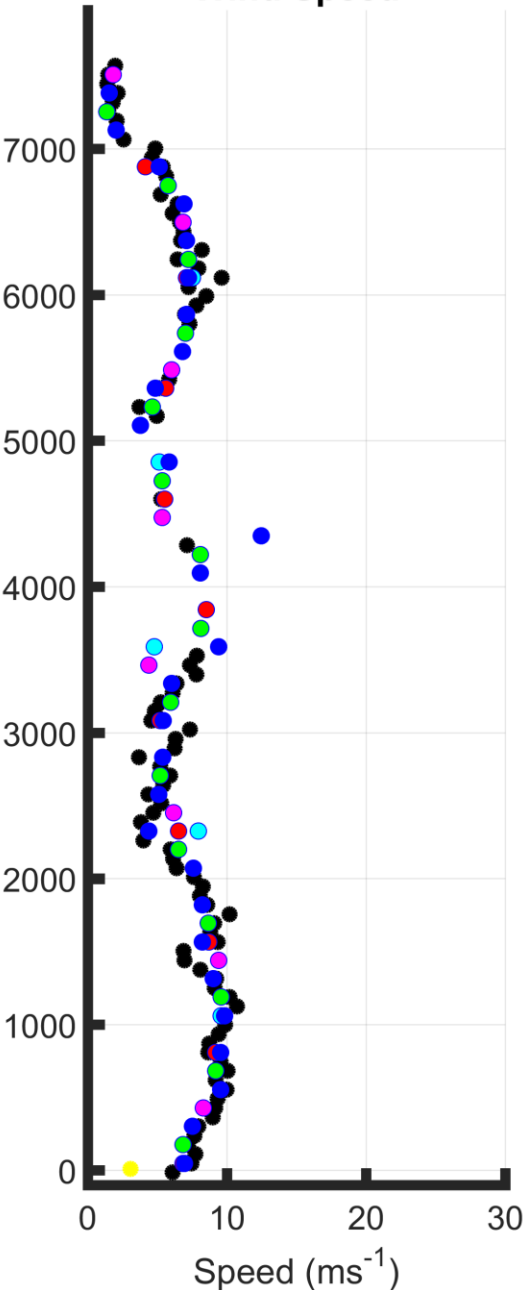
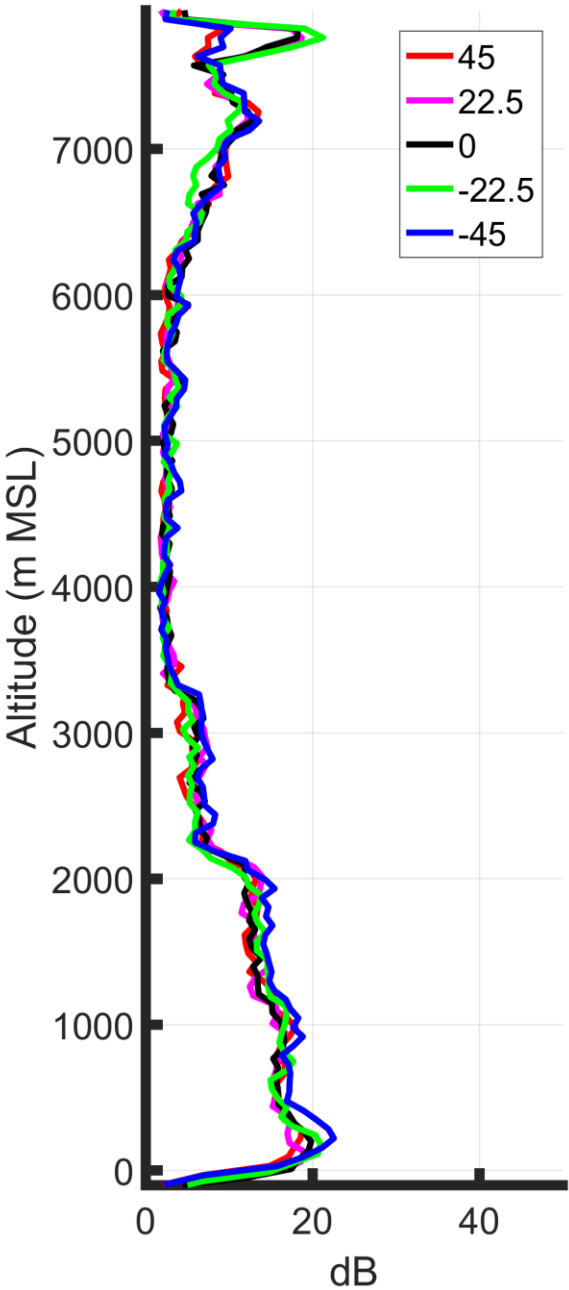


LOS SNR

Wind Speed

Wind Direction

Mid Point Box A
Western Leg

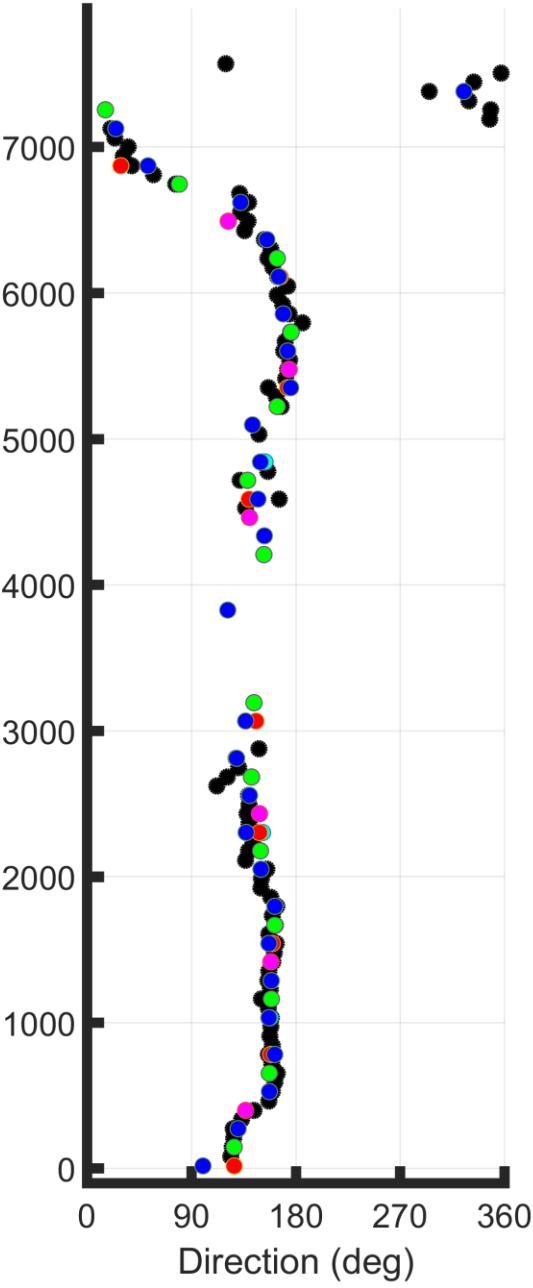
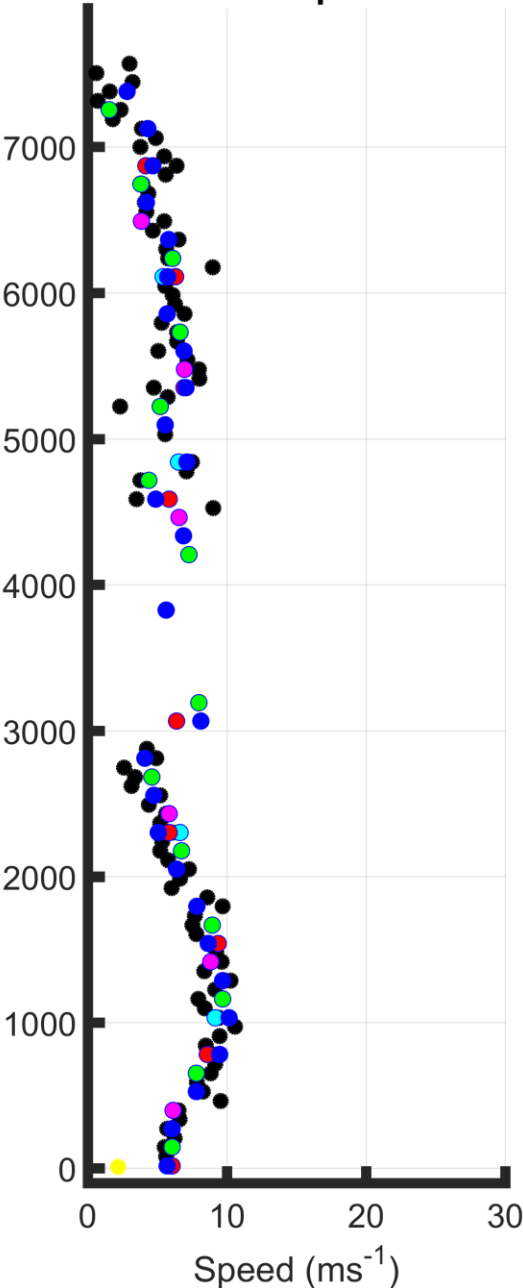
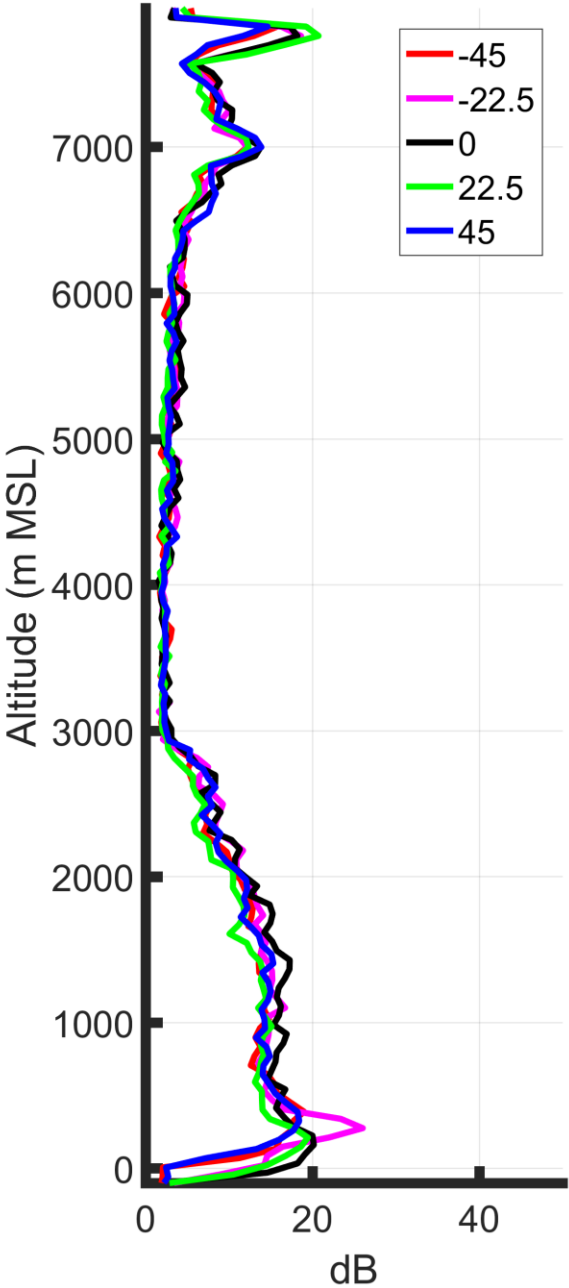


LOS SNR

Wind Speed

Wind Direction

Mid Point Box A
Northern Leg

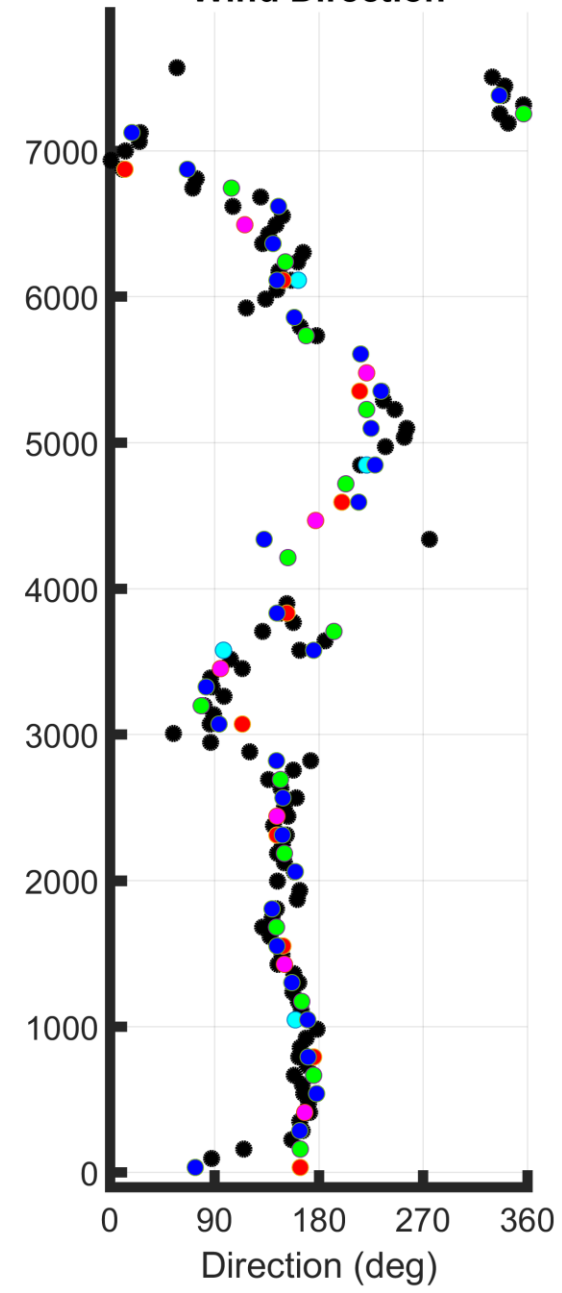
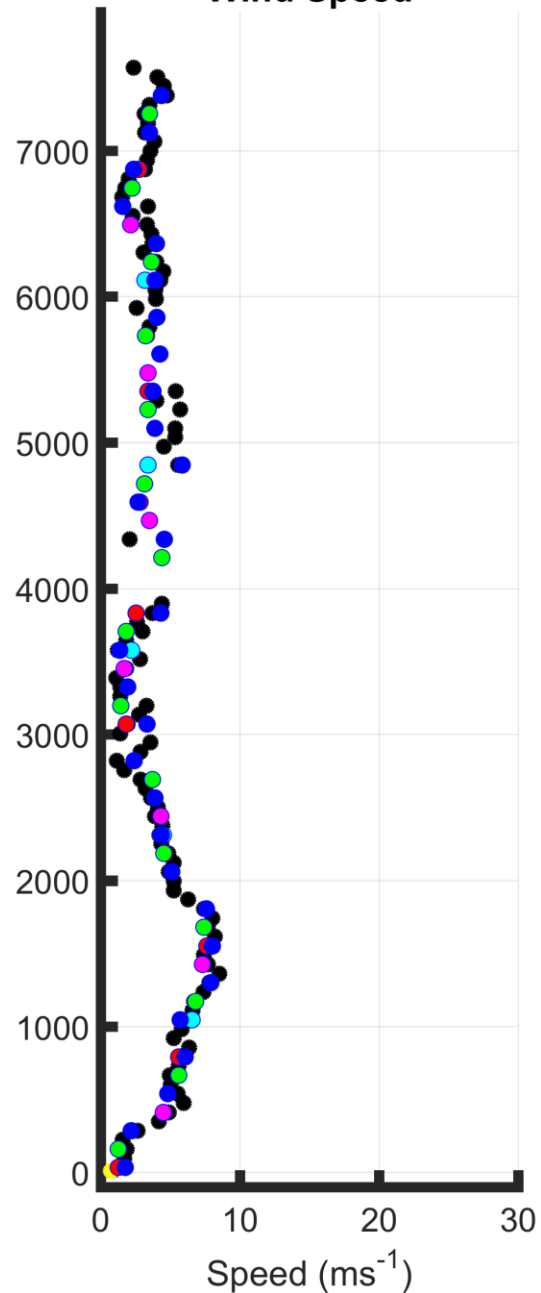
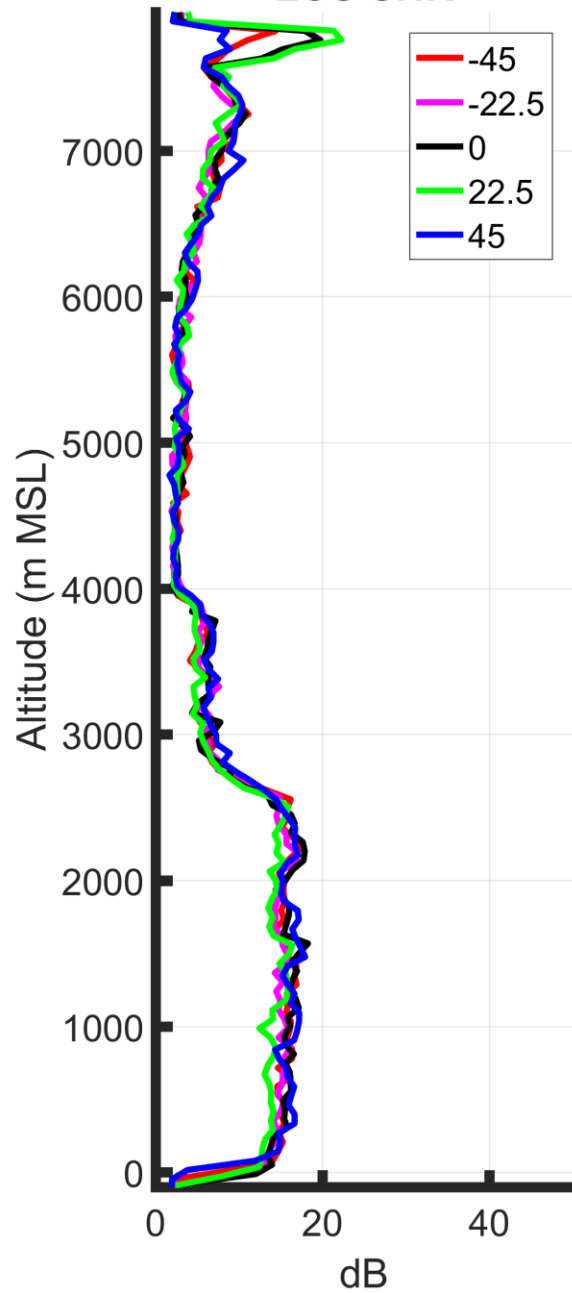


LOS SNR

Wind Speed

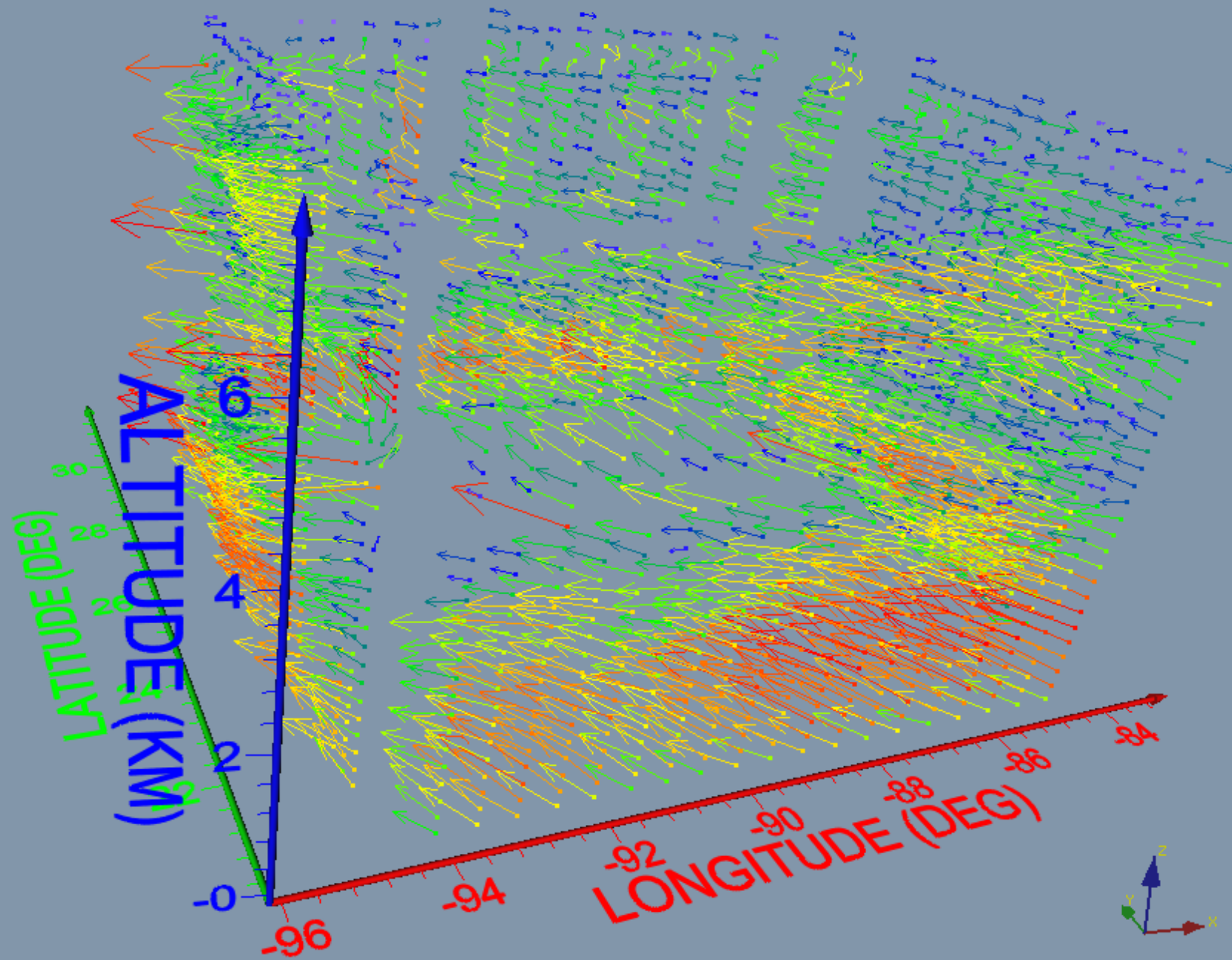
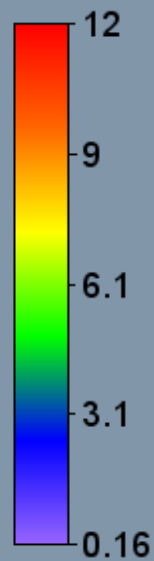
Wind Direction

Mid Point Box A
Eastern Leg



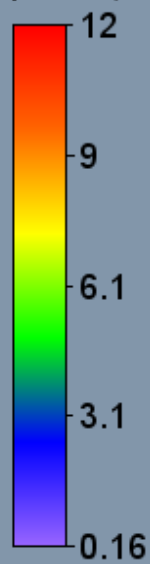
2017/05/27 BOX A

Wind Speed (m/s)



2017/05/27 BOX B

Wind Speed (m/s)



LATITUDE (DEG)

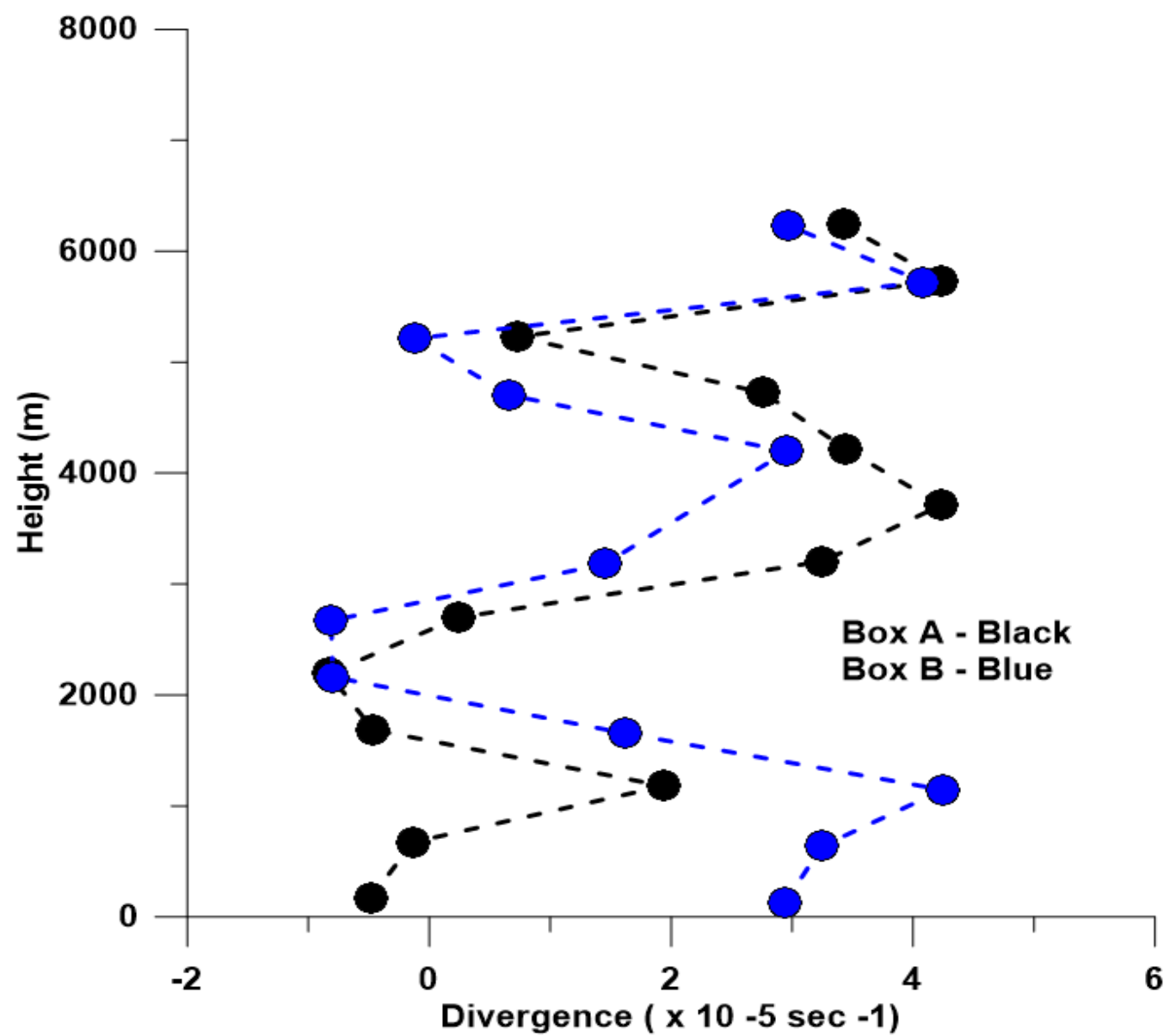
ALTITUDE (KM)

6
4
2
0

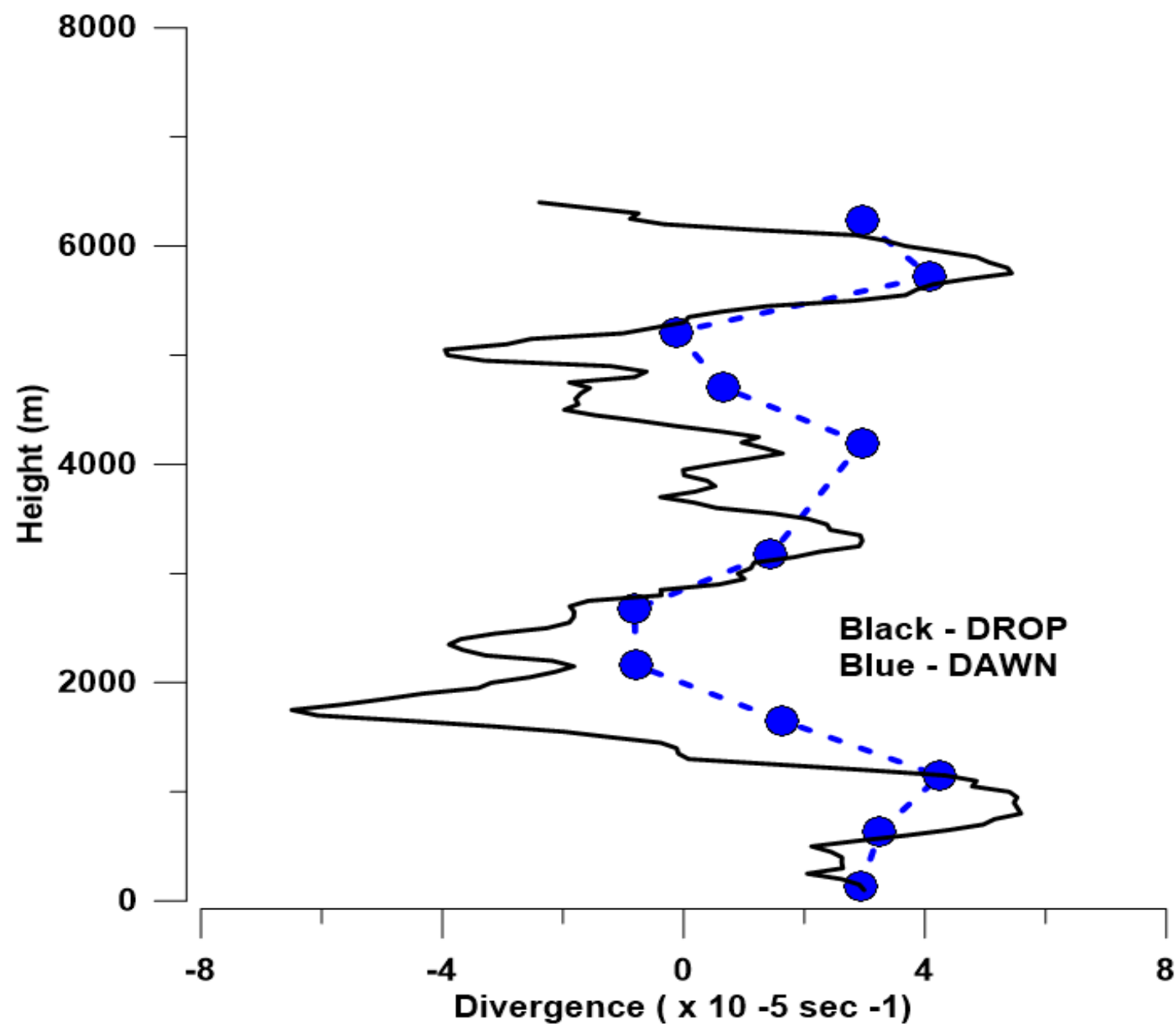
LONGITUDE (DEG)



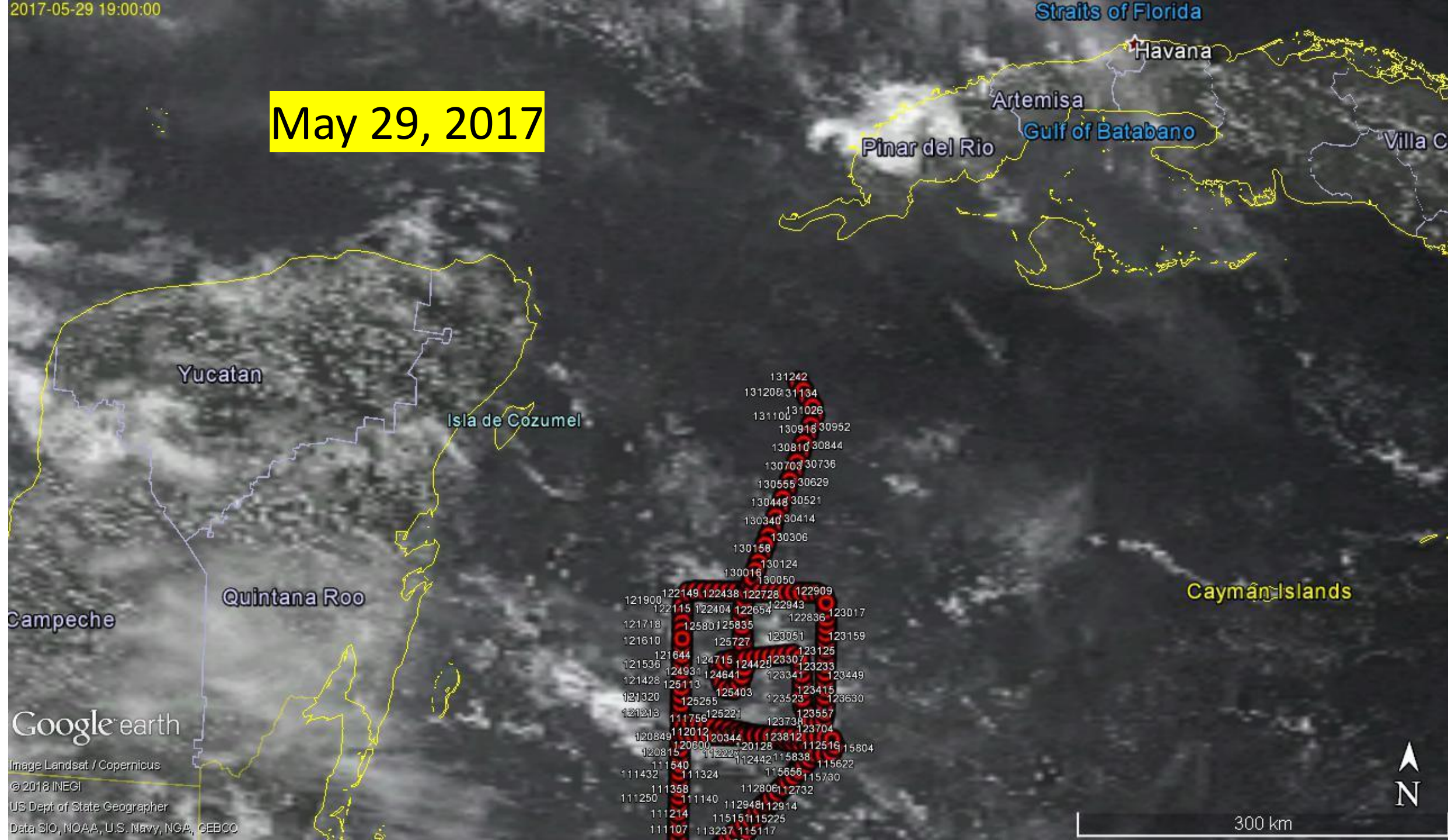
Mass Divergence Over Consecutive CPEX Boxes
05/27/17



Mass Divergence Over CPEX Box
05/27/17 Box B



May 29, 2017



2017-05-29 19:00:00

May 29, 2017

DAWN Profile ~ Every 7 Km

5 Look 4 second dwell

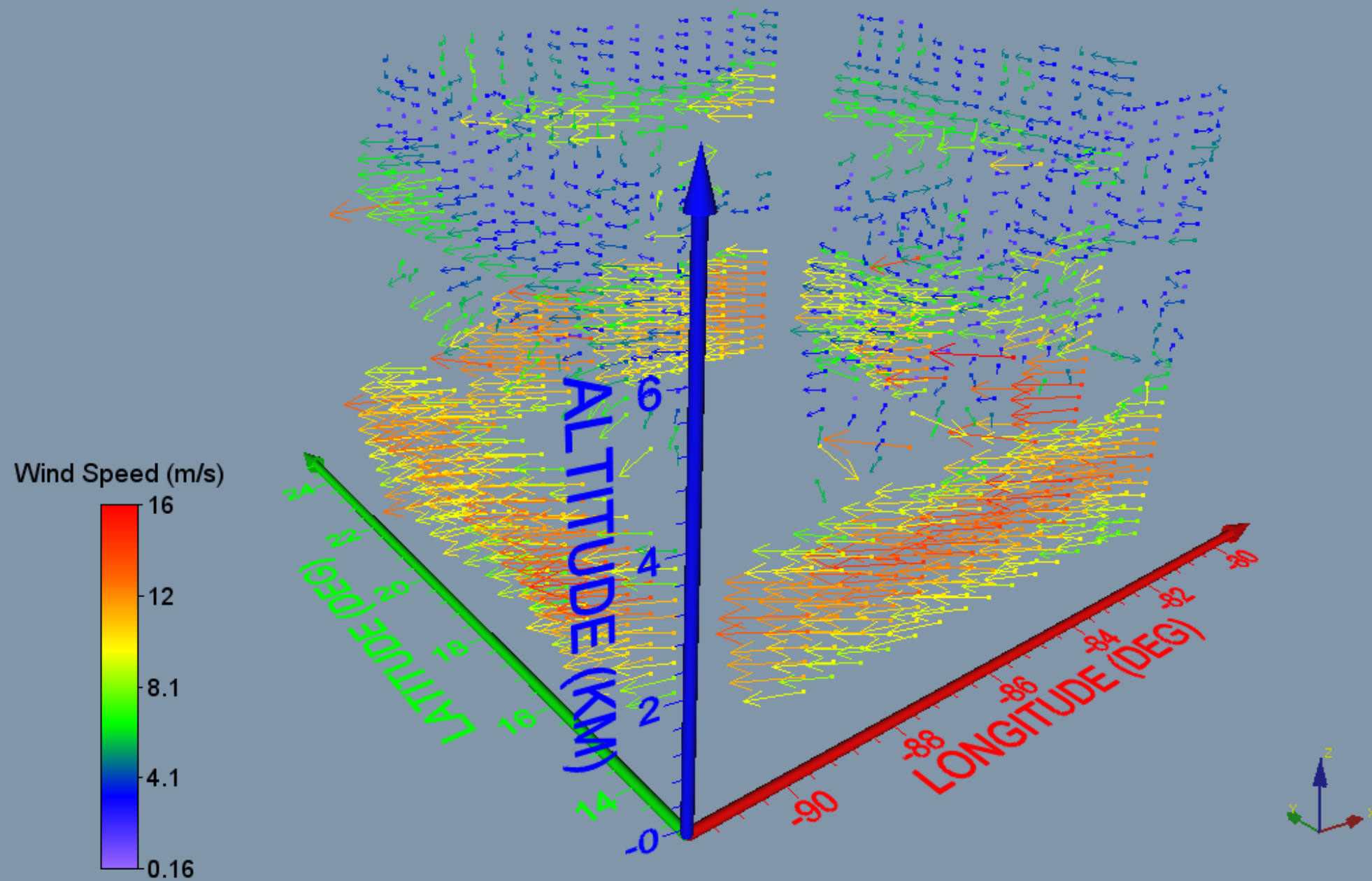
Google[®] earth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

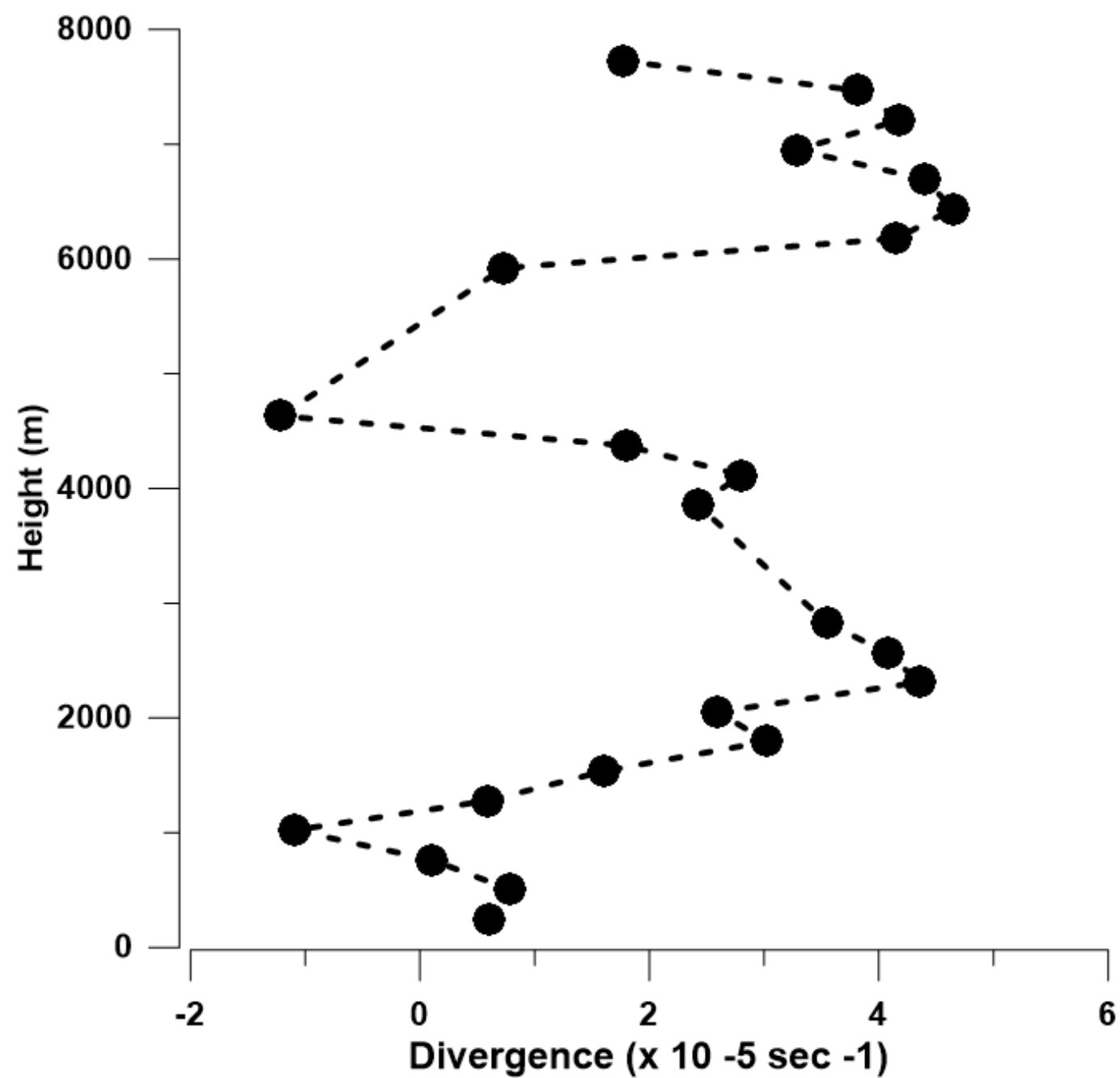
40 mi



2017/05/29 BOX

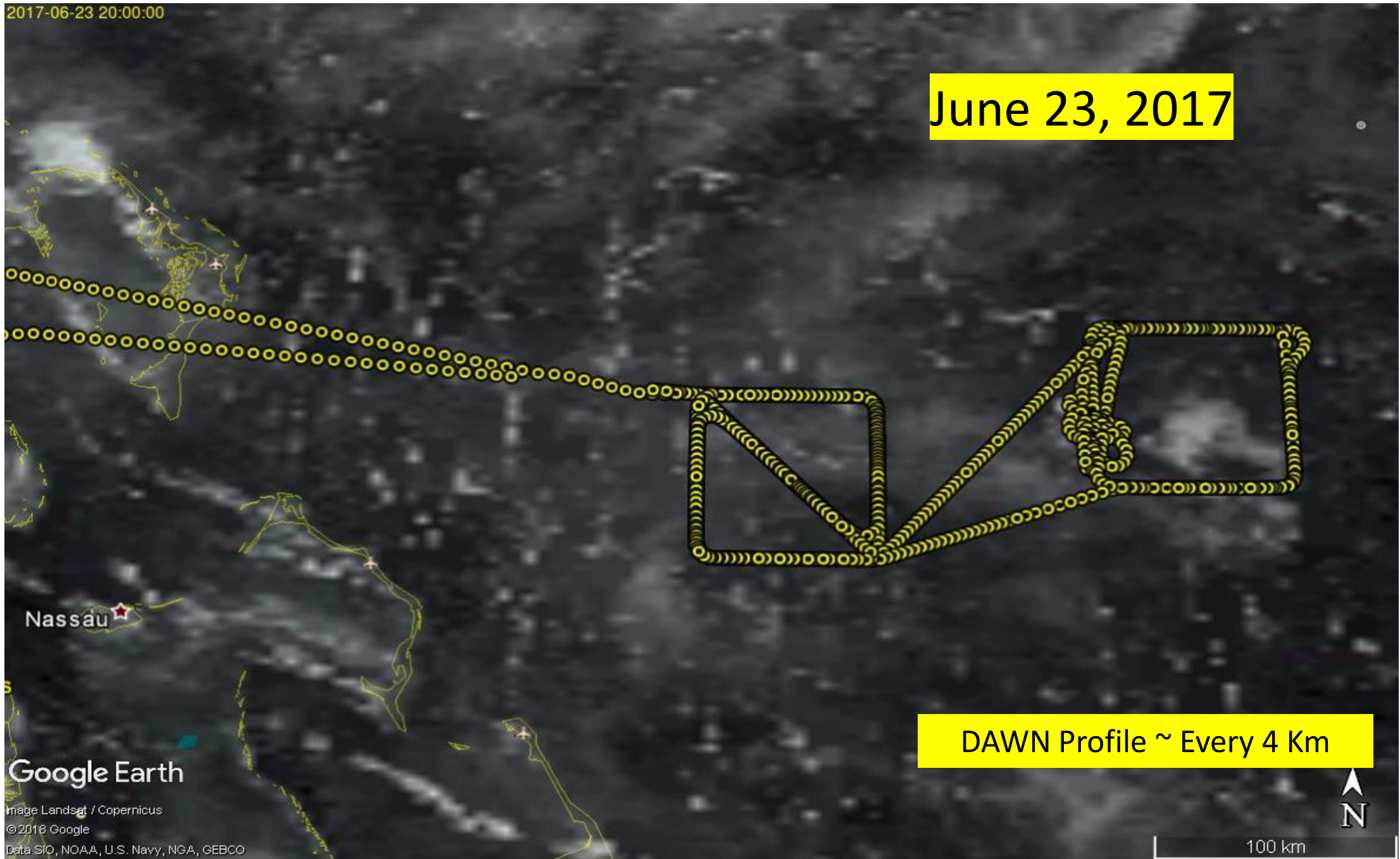


Mass Divergence Over CPEX Box
05/29/17



2017-06-23 20:00:00

June 23, 2017



Nassau

Google Earth

Image Landsat / Copernicus

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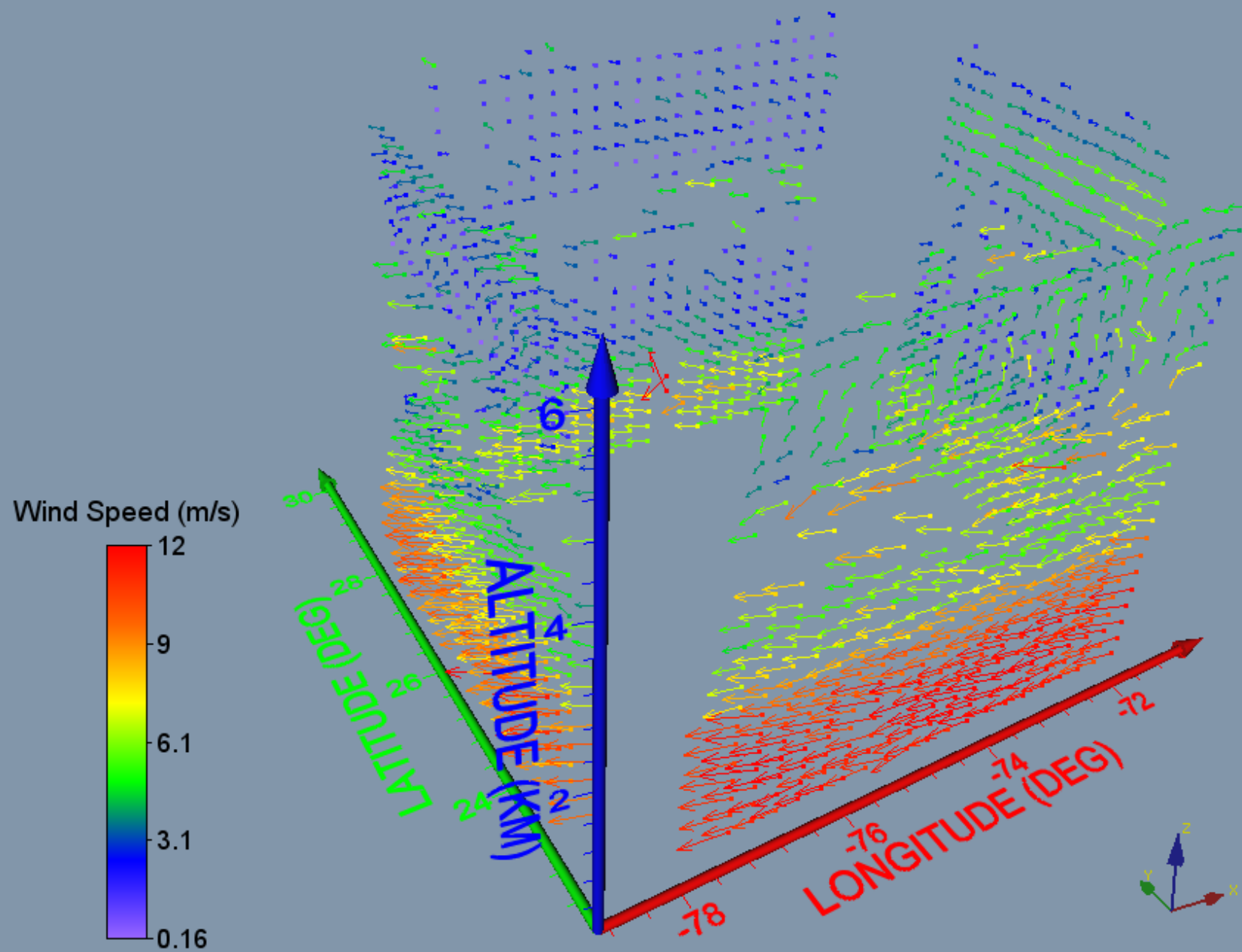
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

DAWN Profile ~ Every 4 Km

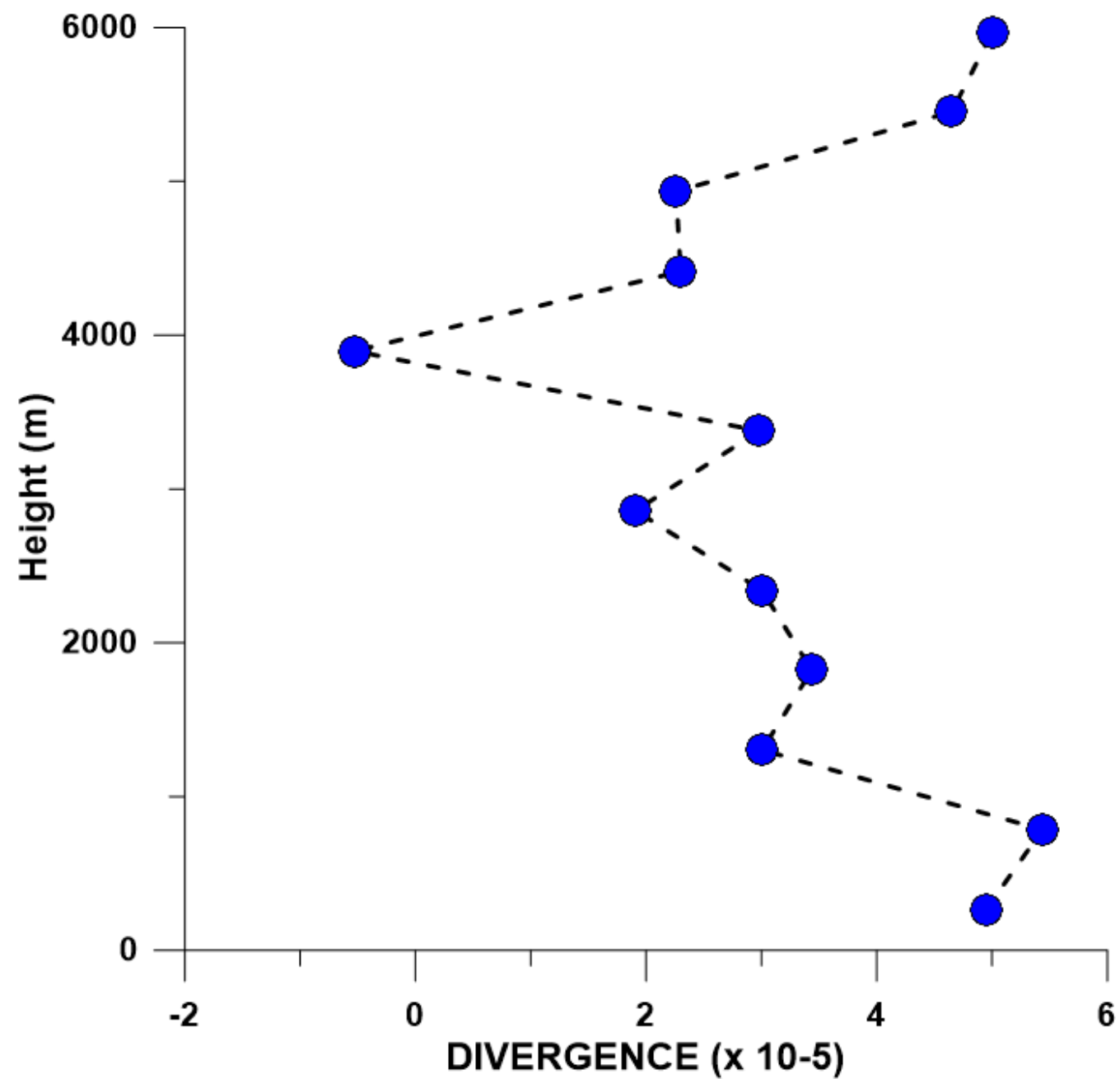
N

100 km

2017/06/23 BOX

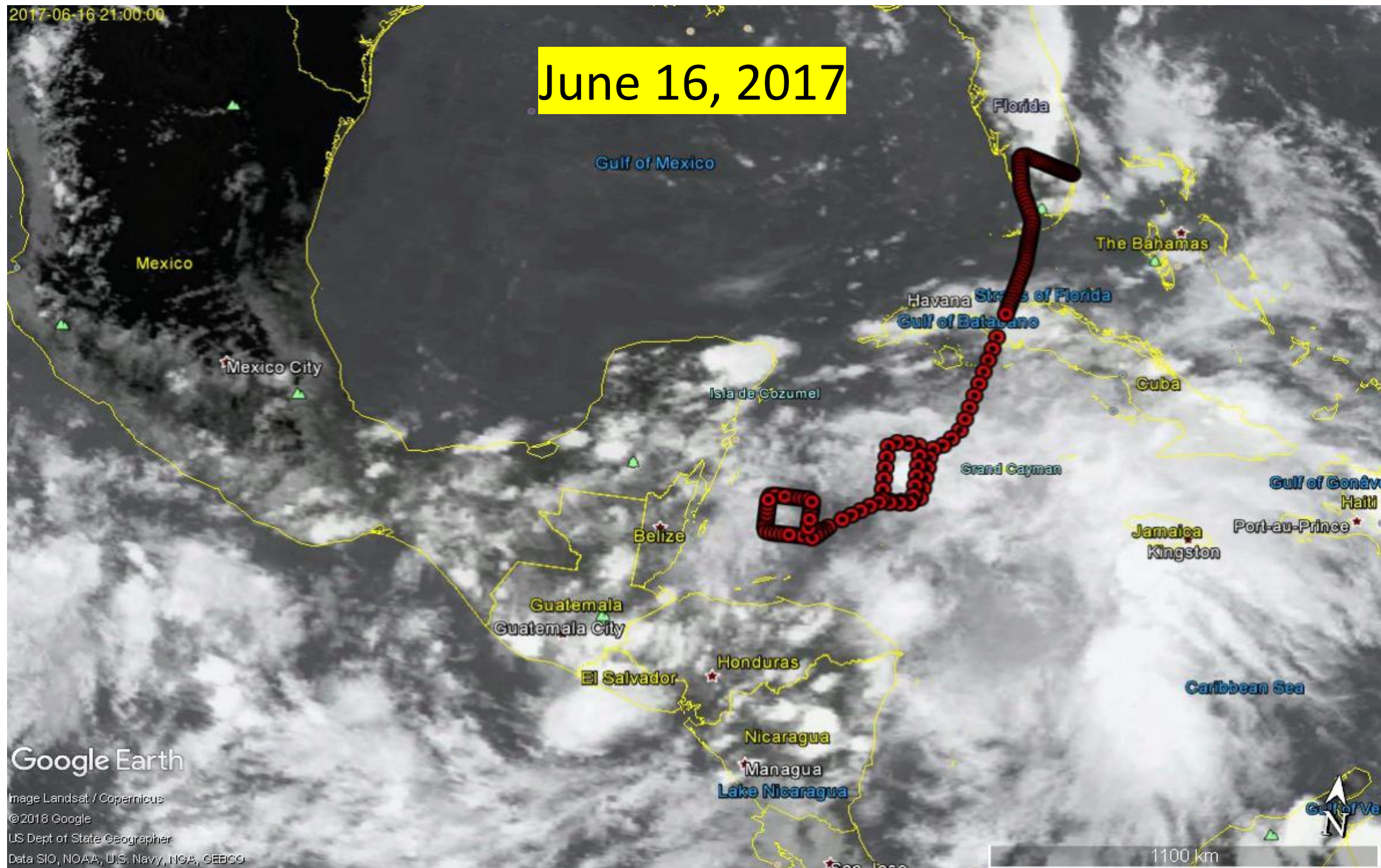


062317 CPEX BOX D
Mass Divergence



2017-06-16 21:00:00

June 16, 2017



Google Earth

Image Landsat / Copernicus

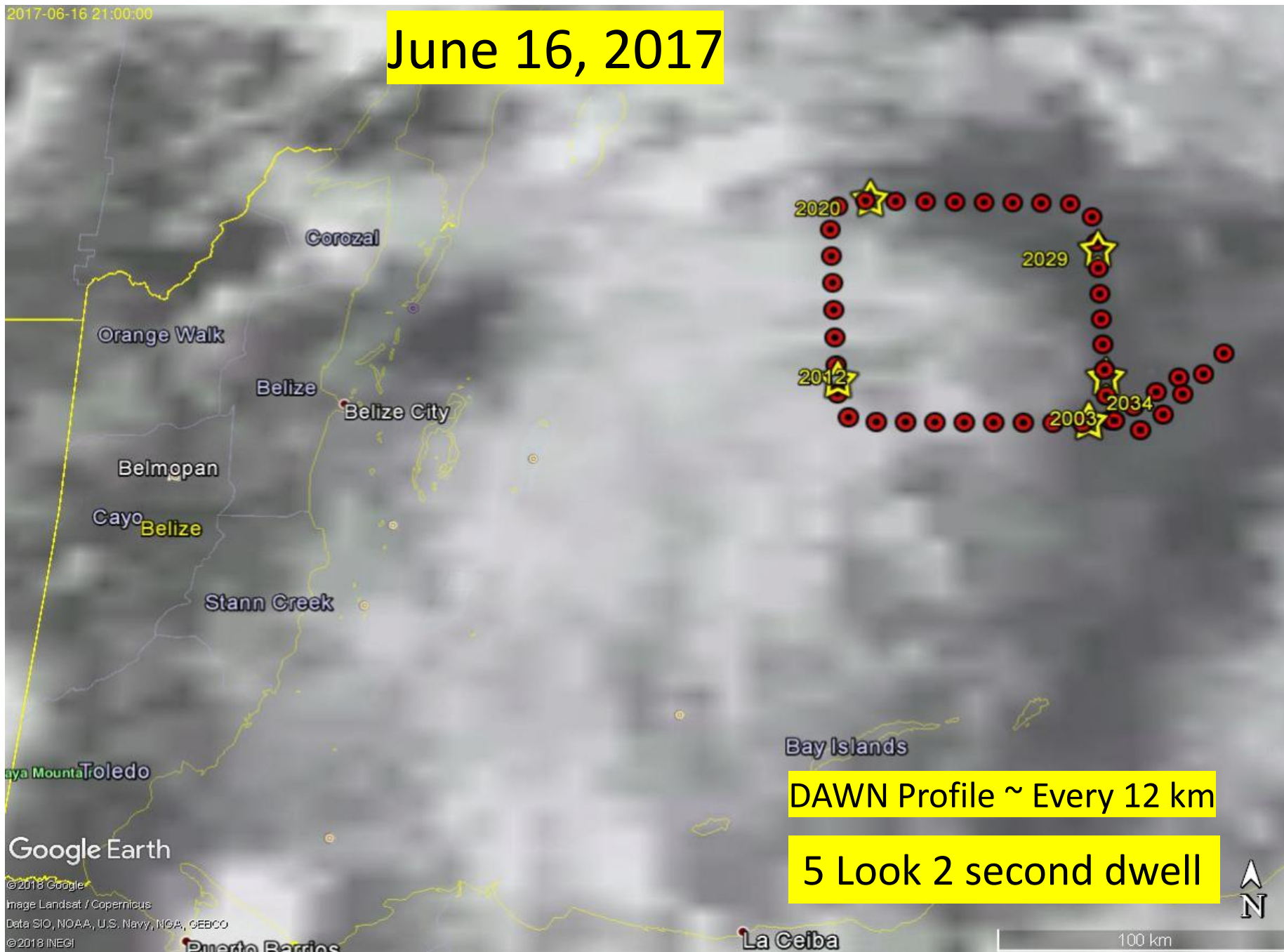
© 2018 Google

US Dept of State Geographer

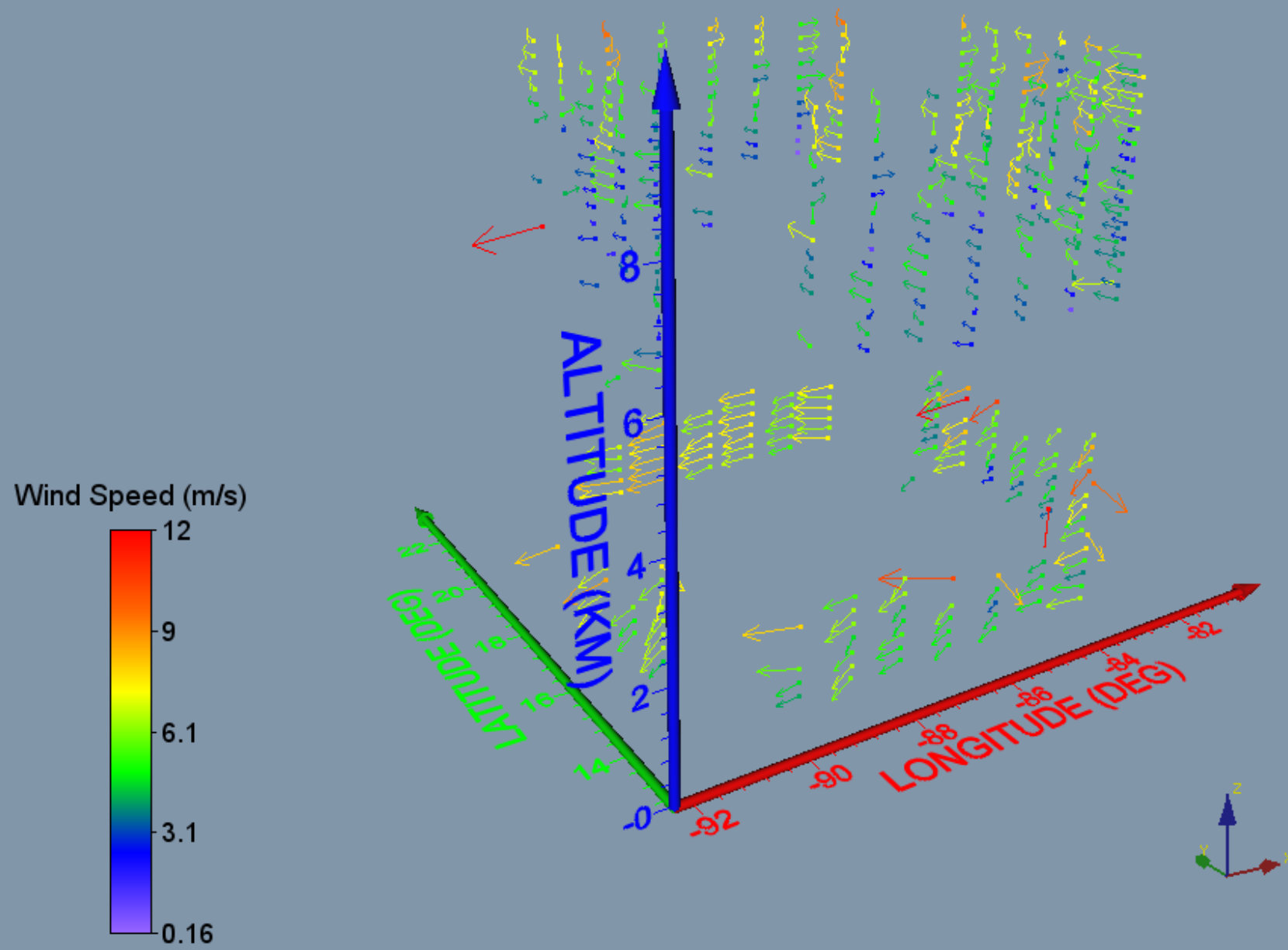
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

2017-06-16 21:00:00

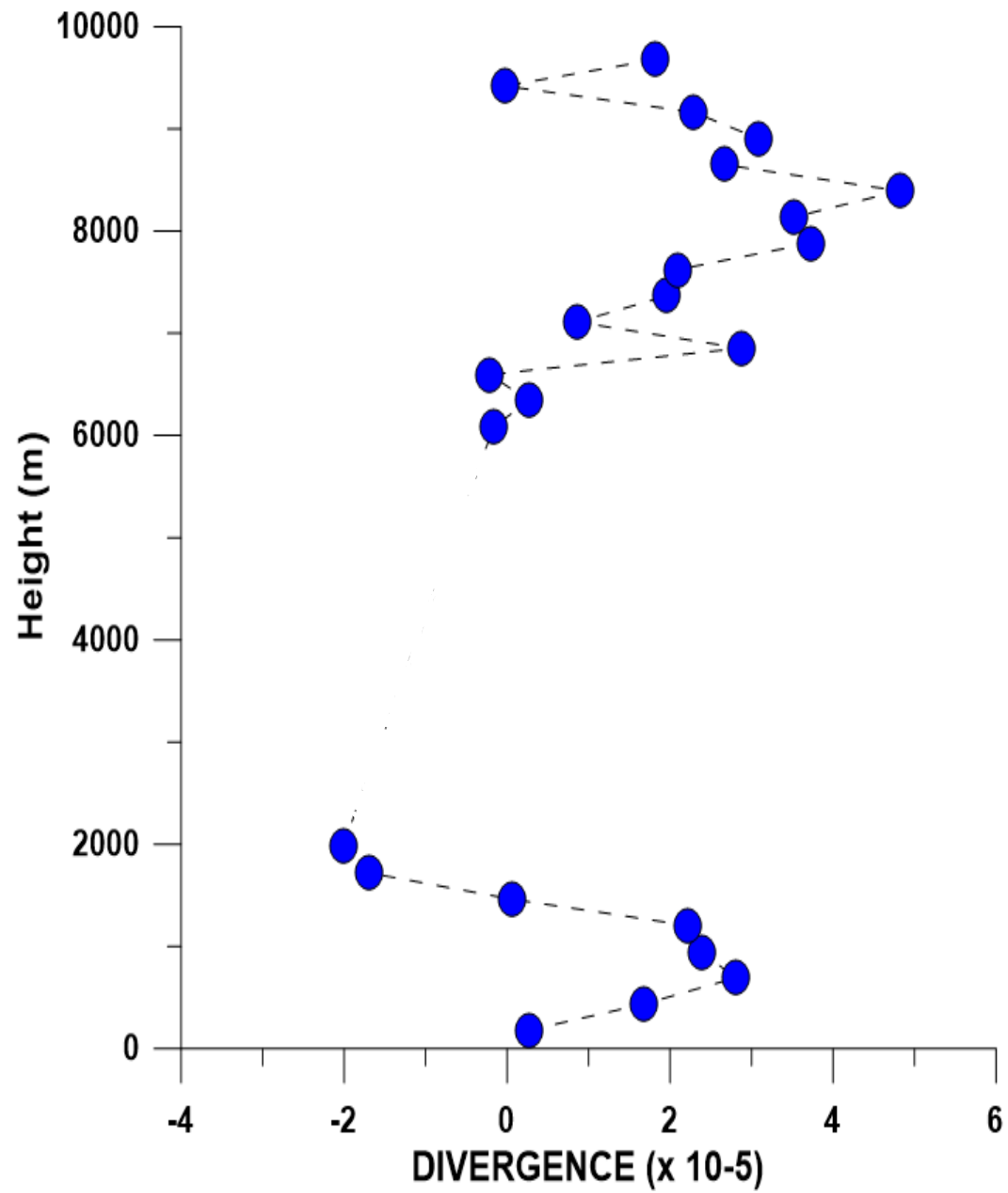
June 16, 2017



2017/06/16 BOX



O61617 CPEX BOX B (Belize)
Mass Divergence



Summary

- The CPEX campaign has provided a unique set of more than 5000 DAWN wind profiles and ~ 275 dropsonde wind, temperature and water vapor profiles during all stages of the convective life cycle
- The DAWN airborne instrument can provide the velocity fields in the clear condition and in the vicinity of scattered and to organized convection (at some levels)
- The DAWN data have been used to compute mass budgets and divergence for 100 km x 100 km x 8-10 km volumes containing various degrees of cloud coverage ranging from cloud free to broken and scattered convection.
- Future work will continue on the investigation of the dynamics in more active and growing convection using improved DAWN data coverage (Version 5).